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How Cylinders Are Made in England

Standardization of Operations and the Extensive Use of Molding Machines Have Aided Quantity Production—Finish and Accuracy Are Not Sacrificed

BY H. COLE ESTEP
European Manager of The Foundry

PRESENT day methods of making automotive cylinder castings are the result of a considerable period of evolution dating back to the first motor car and beyond to the time when the first gas engines were built with water-jacketed cylinders. This evolution has followed more or less parallel lines both in Great Britain and the United States. On both sides of the ocean, the specifications of the automotive engineers have become constantly more exacting while the mechanical problems in the way of molding and coring which the foundryman is asked to solve are growing continually more difficult and complicated. As a result, only those plants equipped and organized to turn out the highest grade of gray-iron castings have been able to make a continuous success of automotive cylinder work.

To meet the requirements of this new industry specialty shops have been developed to produce motor-car and motor-cycle cylinder castings exclu-

FIG. 1—ONE OF THE MAIN BAYS IN A TYPICAL FOUNDRY

FIG. 2—MAKING TWO AIR-COOLED MOTOR-CYCLE ENGINE CYLINDERS IN ONE FLASK

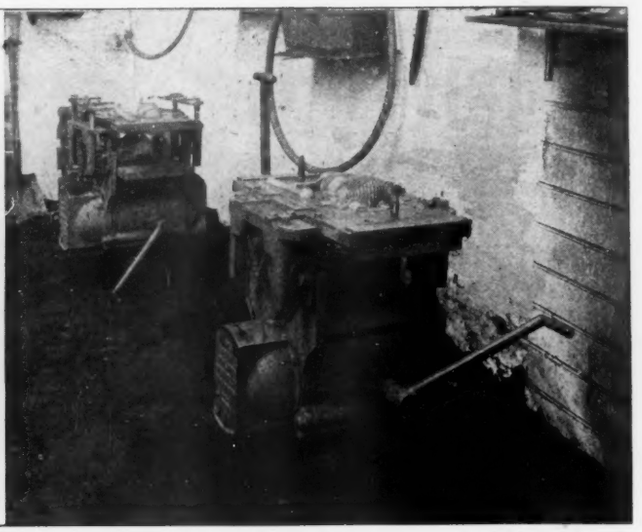


FIG. 3—MOLDING MACHINES RIGGED FOR MAKING AIR-COOLED MOTORCYCLE ENGINE CYLINDERS WITH ATTACHED VALVE CHAMBERS

sively. So far as quantity production is concerned, many of these plants represent the apex of modern foundry development and organization in the gray-iron field.

It can be said fairly that the up-to-date British automotive cylinder foundries are fully equal to those found anywhere else in the world. In some particulars British practice appears to be in the lead—in the direction of attention to the niceties of finish, the elimination of surface defects, complete removal of core-sand, etc. In general, modern British automotive cylinder foundries form an index of what may be expected from the British engineering industries in the postwar period.

One of the most interesting, as well as completely equipped and organized foundries in this line of work in Great Britain is that operated by the Midland Motor Cylinder Co., Ltd., at Smethwick, one of the numerous industrial centers surrounding Birmingham, England. These works are known locally as the Dartmouth Road Foundries. This company specializes exclusively in the production of gray-iron and aluminum cylinders for motor cars, motorcycles and aircraft engines. The organization has an unusually enviable war record in the latter field. The foundry was designed for the work it is doing and at the present time has a capacity of from 16,000 to 20,000 cylinder bores per month. This output requires the melting of 12 to 15 tons of metal per day including iron and aluminum. The shop employs about 500 men.

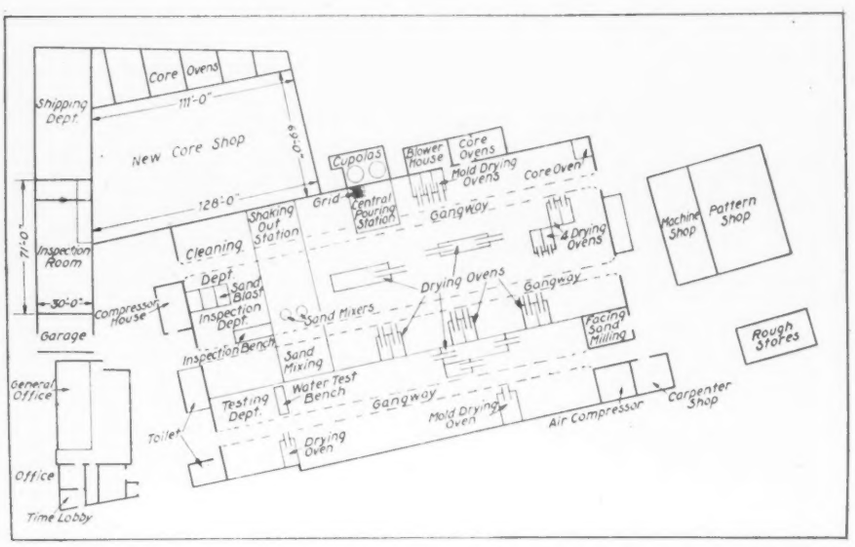


FIG. 4—GENERAL PLAN OF FOUNDRY OF MIDLAND MOTOR CYLINDER CO., LTD., AT SMETHWICK, NEAR BIRMINGHAM, ENGLAND

Automotive cylinders of all types are produced including both the air-cooled and water-cooled varieties, with and without detachable cylinder heads, cast singly, in pairs, or en bloc. Figs. 11 and 12 illustrate some of the numerous types of cylinders made by the Midland Motor Cylinder Co. Some further particulars about the company itself and its interesting history will be presented later.

The general arrangement of the company's foundry is shown in the accompanying plan, Fig. 4. The building, which consists of brick columns and pilasters with brick curtain walls supporting a steel-framed glass and tile roof, is approximately 235 feet long and 140 feet wide, with a core shop of somewhat irregular shape, 69 x 128 feet, built to one corner. Various auxiliary buildings surround the main building, the company's property covering about 2 acres. The principal auxiliary structures include the pattern shop, 40 x 60 feet, and machine shop, 20 x 60 feet, under one roof at the rear of the main building; the rough stores shed, 20 x 60 feet; the shipping room, 30 x 71 feet; and the general offices. The location of these and other minor departments is shown clearly in Fig. 4

Each Floor a Unit

The main building is divided into three longitudinal bays by a wall and a row of brick columns, one of these bays being about 48 feet and the other two each about 46 feet wide. A pair of overhead trolley rails extends the full length of each bay for the convenient handling of materials. There is also a floor gangway down the center of each bay. The various molding floors are located alongside of these gangways. Since most of the work is dry-sand, a large number of drying ovens, or stoves as they are called in England, are necessary. The shop is equipped with 16 such mold-drying

stoves. Four of them may be seen, two on the right and two on the left, in Fig. 1. They are of uniform brick construction with solid, sliding, counterbalanced steel doors. Gas is used for fuel, the burners consisting of one or two perforated 2-inch pipes extending along the floor of the stove. The single ovens, generally speaking, are 6 feet wide, 10 feet long and 6 feet high. There are also three double-ended ovens 20 feet long and 6 feet wide.

These ovens are not placed in a group but are scattered all around the shop, in close proximity to the various molding floors, as shown in Fig. 4. If the molding machine and other equipment be added, each floor may be considered as a unit a small foundry in itself, capable of turning out finished molds ready for pouring.

At present the coremaking facilities also are scattered around the shop, but in order to provide more molding-floor area, and to concentrate the coremaking in a single department, in accordance with the latest practice, the new core-room shown in Fig. 4 is being completed. It is trapezoidal in shape, 69 feet wide, and 128 feet long on one side, next to the foundry, and 111 feet on the other. The core ovens will be ranged along the shorter side as shown in Fig 4, backing up against the private road which separates the Midland Motor Cylinder Co.'s property from that of the Birmingham Aluminum Castings Co., next door. These two companies are controlled by the same interests. The new core-room will be fully equipped for the rapid production of the numerous complicated oil-sand cores necessary for cylinder work.

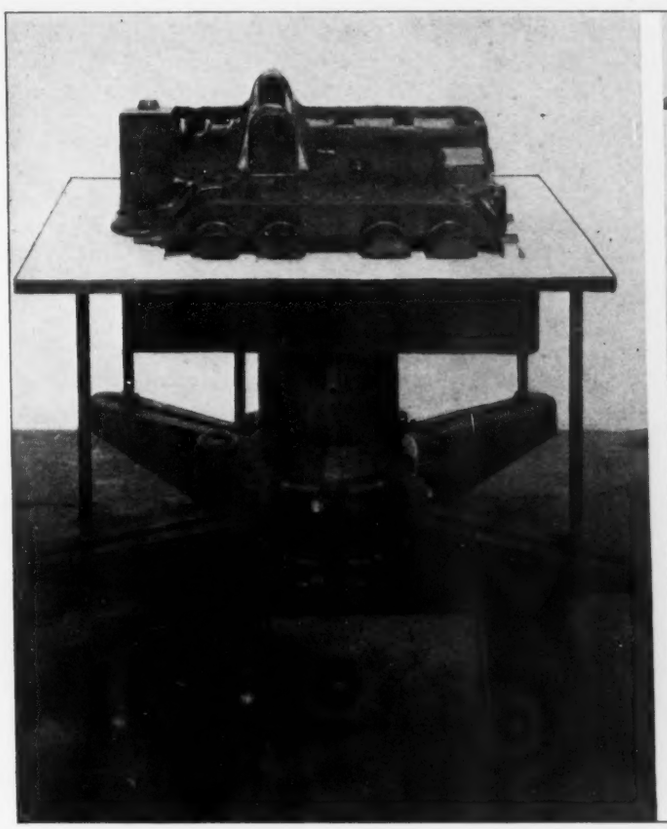
In addition to the new core ovens there are nine gas-fired ovens now in operation in various parts of the foundry, together with two portable ovens. The temperature of the core baking is controlled by recording thermometers furnished by the Cambridge Scientific Instrument Co., Cambridge, Eng. Ordinary jacket cores are baked at a maximum heat of about 450 degrees Fahr. for two hours, the entire baking period being about six hours.

How the Molds are Handled

The two cupolas are located in the middle of the shop at one side in the usual manner. A good many of the small air-cooled cylinders are poured from hand shanks on the floors where they are made, the metal being carried by hand from the cupolas. Some of the water-cooled cylinders are also so treated, using a trolley ladle.

However, it is the general practice in this foundry to bring many of the molds to the cupola for pouring, instead of carrying the metal to the molds. This of course serves floor space at the molding stations, avoids accidents through concentrating the pouring operations at one point, and makes it certain that each casting will receive the hottest possible metal fresh from the cupola before any oxidation of other atmospheric influences, virtually all of which are deleterious, have had a chance to operate. This is perhaps the strongest argument in favor of the central pouring station alongside the cupolas.

For the purpose of pouring, a casting grid, of cast iron, about 25 feet square, is located directly in front of the cupolas as shown in Fig. 4. Below the grid is a shallow pit into which the spillings, etc., are dropped. The molds are brought to the pouring station by an Edison storage-battery truck, of the lifting type, built by the Edison Accumulators, Ltd., London. The truck has a rated capacity of 40 hundredweights, or 4480 pounds. The molds are usually handled in batches of four, and for this purpose they are assembled on low stands made of steel plate which can be picked up by the lifting arm of the truck. A group of molds which will be ready for their journey to the pouring stations as soon as they are closed up are shown



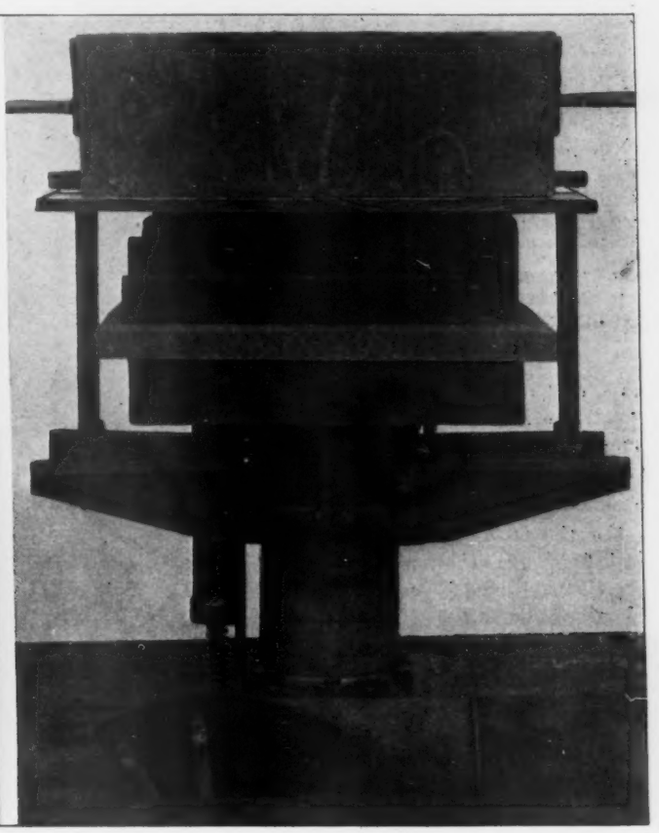


FIG. 5—ELECTRO-PNEUMATIC JAR-RAMMING MACHINE SHOWING CONTROL LEVERS FIG. 6—ELECTRO-PNEUMATIC JAR-RAMMING MACHINE SHOWING PATTERN-DRAWING MECHANISM

in their places an assembly truck in Fig. 9.

After they are poured, the battery truck transfers the molds to the shaking-out station which occupies almost the entire width of the foundry near one end, as shown in Fig. 4. Here the castings are shaken out of the sand and most of the cores removed.

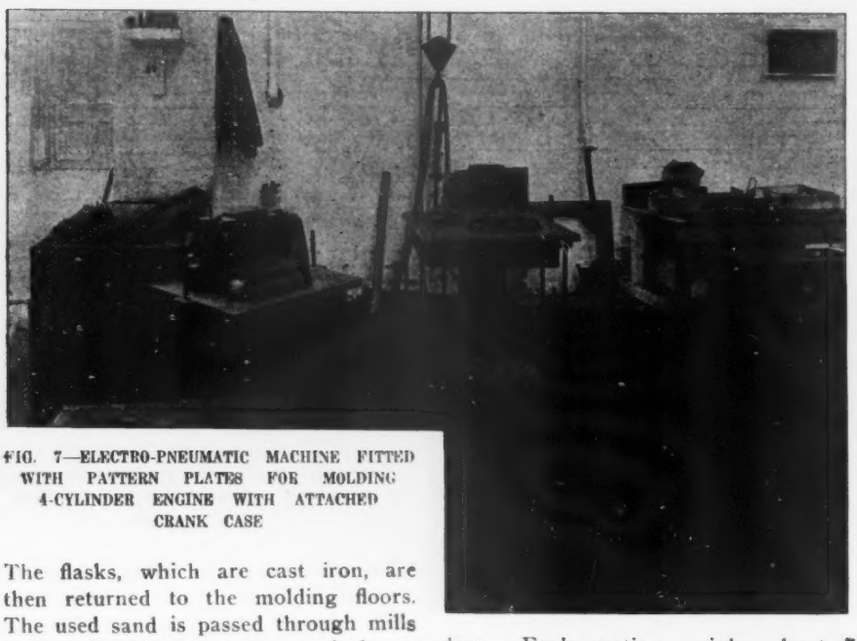


FIG. 7—ELECTRO-PNEUMATIC MACHINE FITTED WITH PATTERN PLATES FOR MOLDING 4-CYLINDER ENGINE WITH ATTACHED CRANK CASE

The flasks, which are cast iron, are then returned to the molding floors. The used sand is passed through mills located in this department and thence back to the floors.

For the final core removal and general finishing the castings pass on to the cleaning department which is located alongside the shaking-out station. It is equipped with the usual benches and with four sand-blast rooms of the double-ended type through which each of the castings passes. After being sand-blasted the castings undergo a rigid inspection and pass on to the water-test bench, Fig. 11, where they are subjected to hydraulic pressure of 80 pounds per square inch, which they must withstand without leaking or sweating.

Molding Air-Cooled Cylinders

To return now to some of the details of the molding practice in this interesting British foundry, Figs. 2 and 3 show how molding machines are used for making air-cooled motorcycle cylinders. The machines employed are of the stripping-plate, pattern-drawing and hand-ramming type manufactured by the Adaptable Molding Machine Co., Sydney Works, Birmingham, England. These machines, as previously described in THE FOUNDRY, are adjustable to flasks of any size within the range of the machine simply by turning a handle.

In Fig. 2 a standard machine provided with a double lift attachment is shown fitted with a pattern-plate for molding the Blackburne air-cooled motorcycle engine cylinder. Since the casting is nearly symmetrical, a two-part flask is employed and both the cope and drag are made of the same reversible pattern-plate. Two castings are made in each mold. The flasks, which are of heavy cast iron, are 11 x 14 inches in size and 5 inches deep. Each casting weighs about 7 pounds. In making the mold, the air cooling fins are drawn through the stripping-plate, and the mold is then lifted off the pattern by means of the side frames with which the machine is provided. The flasks are provided with interchangeable pins, and are clamped together by keys which are driven through slots milled in the projecting ends of the pins. The flask walls are about ⅜-inch thick.

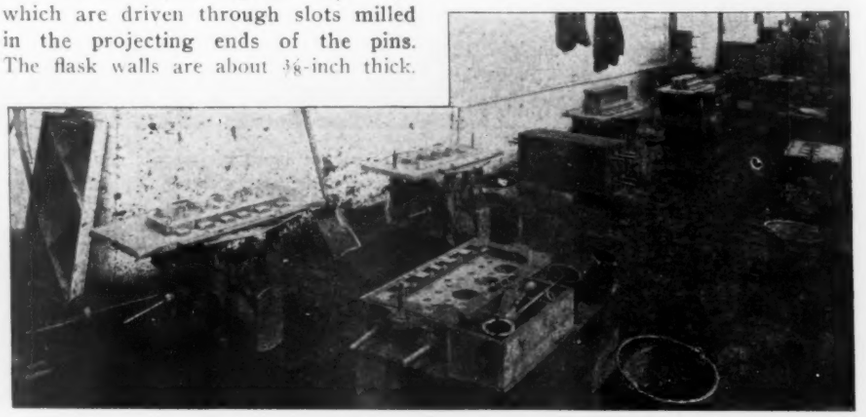


FIG. 8—BATTERY OF MOLDING MACHINES MAKING THREE-PART MOLDS FOR 4-CYLINDER ENGINE

The molds are dried in one of the nearby gas-fired ovens, after which the plain barrel core employed is set in place and the two parts clamped together and upended for pouring, the job being cast with the top of the cylinder downwards. Before drying, the molds are blacked with an air atomizer and the fins are brushed by hand with blacking mixed with a core-gum binder in order to prevent the fine ends of the fins from being washed away by the hot metal. The method of gating is shown clearly in Fig. 2. For pouring, a cast iron pouring basin is employed, without a skim-gate, a number of these little pouring basins being shown at the right in Fig. 2. Two men and a boy make 35 molds in eight hours and pour-off their own work.

Another interesting air-cooled job, a Martynside cylinder with inlet valve chamber cast on, is shown in Fig. 3. In this case, on account of the projecting valve chamber, only one casting is made in a 11 x 14-inch flask, the flask being, as in the previous case, in two parts each 5 inches deep. The gating arrangement is shown very clearly in the nearest pattern plate illustrated in Fig. 3. This job also is handled on Adaptable molding machines. One machine makes the copes and the other the drags. The machine shown in the rear in Fig. 2 illustrates how the side frames lift the mold from the pattern-plate.

Electro-Pneumatic Jarring Machine

Primarily for their own use, the officials of the Midland Motor Cylinder Co. invented and developed an exceedingly interesting jar-ramming machine which operates on the electro-pneumatic principle. This machine is now being marketed. It was described in a paper on European molding machines published in the Oct. 15 issue of THE FOUNDRY. Some further details, however, would be of interest. Figs. 5, 6 and 7 show how the machine is used in the Midland company's own foundry for making 4-cylinder engine blocks.

As previously described, the machine consists essentially of an electric motor geared to a piston which operates in the lower part of the cylinder into which the table plunger is fitted. As the piston moves upward, the air between it and

FIG. 9—ASSEMBLING THE MOLDS MADE ON THE MACHINES SHOWN IN FIG. 8

the plunger is compressed until it attains sufficient density to lift the table and mold. This operation uncovers the exhaust ports, which relieve the pressure, allowing the table to fall back, thus jar-ramming the mold. The piston and plunger are so arranged that they can never come into direct contact; there is always an air cushion between. With this machine a separate supply of compressed air is unnecessary. Other advantages are claimed which have been previously referred to. The intensity of the blow does not depend entirely on the weight of the table and mold; the piston as it descends creates a partial vacuum, which may be adjusted, thus sucking the table down with a veriable additional force.

The machine shown in the accompanying illustrations has an 8-inch cylinder and a 10-inch lift, with an 18 x 24-inch table. It will take pattern plates up to 4 x 6 feet and handle molds weighing half a ton with a 5-horsepower motor. Fig. 6 shows the adjustable standards on which the pattern-plate and flask are supported while the pattern is being drawn down, the pattern-drawing lead screw being also clearly shown at the left.

As the machine is installed in the foundry, the motor and other working parts are in a pit below the floor level. This protects them from foundry grit, and at the same time brings the operating table to a convenient height.

Fig. 7 shows the machine rigged-up for making Wolseley 4-cylinder blocks which are cast with the crank case attached. A heavy two-part cast iron flask is employed, the mold being divided through the center of the engine as shown. This enables a straight draw to be obtained without resorting to excessive use of loose pieces. The two halves of the pattern are mounted on separate plates. The flasks are 24 x 28 inches in size and 12 inches deep. The weight of the complete mold is about 600 pounds. The pattern is of course drawn through a stripping-plate which is 1 inch thick. The flask is subsequently lifted off the long pins fitted in the plate.

The main crank-case and barrel cores, which are integral, are made in halves and pasted together when the

FIG 10—ONE OF THE CORE-MAKING CENTERS

FIG. 11—TESTING BENCHES WHERE HYDRAULIC PRESSURE IS APPLIED TO COMPLETED CYLINDERS

molds are assembled. The usual jacket cores, timing-case cores, etc., also are set at this time. The two halves of the mold are securely bolted together, and turned up on one side for pouring, the cylinders being cast with the crank-case at the top through two runners connected to either end of the crank-case. A man and a boy operate the machine; another man finishes the molds, while two men are employed setting the cores, closing and casting.

In many cases in automobile cylinder work a three-part mold is necessary. A job of this character is illustrated in Figs. 8 and 9, which shows the method of molding cylinders for the 20-horsepower Austin motor. As Fig. 8 indicates, four Adaptable molding machines are used two for making the cheeks, or middle parts, and one each for the copes and drags, or top and bottom parts. This battery of machines is operated by two men and four boys, the latter working the machines and the former doing the more skilled work involved in assembling and closing the molds. The castings weigh approximately 112 pounds.

The flasks are 13 x 28 inches in size, the cheeks being 7½ inches and the copes and drags each 4½ inches deep. The method of making the tops and bottoms is shown clearly at the left in Fig. 8. The patterns for the middle part are divided into two parts, the loose top-part being drawn from the top of the mold by hand before drawing the bottom-part, 6 inches, by the machine. These cheek molds are shown clearly in Fig. 9, with the part of the pattern drawn on the machine

FIG. 13—GENERAL VIEW OF THE PATTERN SHOP

FIG. 12—GROUP OF CASTINGS IN CLEANING ROOM SHOWING LARGE VARIETY OF AIR AND WATER-COOLED CYLINDERS MADE

facing the reader. The overhanging masses of sand in the cheek between the cylinder barrels are secured by the liberal use of nails. The British type of flat foundry nail cut from sheet-iron is employed. The cope part of the mold contains only the gates and prints for the barrel cores. The drag mold carries the cylinder head, the engines being of the L-head type.

All parts of the mould are sprayed with blacking with an atomizer and then dried in one of the adjoining ovens. The dried molds are assembled in batches of four each on low benches as shown in Fig. 9. They are then taken to the pouring station for casting.

Each mold is provided with a pouring basin as shown in the background in Fig. 9. In order to insure fast pouring and prevent entrapped air-bubbles, the top of the runner is covered by a flat-based, cone-shaped iron

plug while the pouring basin is being filled. This plug is attached to the end of a rod so it may be removed, uncovering the runner, as soon as the basin is full. This also insures the casting being filled only with clean metal, which seeks the bottom of the basin, and obviates the use of dry-sand strainer gates.

The pouring gang in front of the cupolas consists of four men. The metal is tapped first into a 1350-pound truck ladle which runs on a track between the two cupolas. For the actual pouring operation, the ladle, which is geared for tilting, is hoisted up by an electric overhead trolley.

The two cupolas were built by Thwaites Ltd., Bradford, England. They have a shell diameter of 48 inches and a diameter inside of lining of 30 inches, both being of the same size. They are rather high, being 20 feet to the charging door. A high blast pressure, varying from 20 to 24 ounces, is furnished by a Thwaites Roots' type blower.

The quality of the metal is judged by the depth of chill at the thin edge of a test wedge, and by direct physical tests which show a tensile strength of around 33,000 pounds per square inch. The normal cupola mixture consists of 67 per cent pig iron and 33 per cent of the foundry's own scrap. No outside scrap is used; its composition is felt to be too uncertain. Extremely hot metal is aimed at rather than fuel economy, the coke consumption being about 400 pounds per ton of iron. The pig iron portion of the charges consists of 40 per cent cold-blast iron which takes the place of the charcoal iron frequently used in American cylinder foundries. It ranges from 1.00 to 1.20 per cent silicon, with about 0.3 per cent phosphorus and 0.06 per cent sulphur. The remainder of the pig iron consists of a small amount, depending on conditions, of 2½ per cent softener pig, and off basic iron. The castings average 1.33 per cent silicon, with about 0.80 per cent phosphorus and 0.108 per cent sulphur. The metal is mixed by analysis, a consulting chemist being retained.

Organization Features

Every effort is made to minimize losses in the foundry and rejections after the castings are machined. A large staff of viewers, or inspectors, is employed and every casting receives a rigid individual examination. About 15 per cent go back into the cupola. With less rigid inspection this figure might easily be cut down, but it is a factor in keeping the machine-shop returns down to less than 5 per cent. Furthermore the company employs a technical expert whose sole duty is to go the rounds of the customers and keep in touch with the way the castings are being used. This man makes a daily report and follows a regular route whether any difficulty has been reported to the foundry or not. Other technical men make a special duty of investigating the causes of machine-shop rejections.

A very effective cost system also is employed which enables the management to keep closely in touch with the financial side of the business. Quotations are made at so much per cylinder rather than at pound rates.

The business was started in April, 1914, by two young partners, Messrs. A. E. Pearce and P. Pritchard. There were only two employes. During the war two shops were outgrown, the present plant being the third to be occupied. It was built in 1917. During the war thousands of aluminum airplane-engine cylinders were made with more than usual success, and in 1917-18 considerable aid was given the American aircraft program.

The officers of the company, which was incorporated in 1915, include the following: H. B. Pearce, chairman, Percy Pritchard and A. E. Pearce, joint managing directors, the former having charge of the technical and the latter the commercial activities of the company; and W. H. Sherlock, secretary. Major A. D. Pearce, late of the Royal Air Force, has rejoined the firm since the cessation of hostilities. T. L. Birks is foundry superintendent.

Completes New Oil Well Machinery Plant

The extensive new plant of the Pomeroy Machine Co., Pomeroy, O., which was commenced on July 24th has just been placed in operation. It is devoted almost exclusively to the production of oil-well castings for the Parkersburg Rig & Reel Co., Parkersburg, W. Va. It is favorably situated to take advantage of both river and rail transportation and is equipped for a production of 125 tons of castings a day.

The group of buildings comprising the plant are a foundry covering an area of 46,500 square feet; a machine shop, 6400 square feet; a pattern shop, 6300 square feet; a pattern storage, 6300 square feet; and a blacksmith shop, 1500 square feet. The main building for foundry use is an Austin standard building to which is added a specially constructed building for housing the cupola and charging floors.

A. V. Wadsworth, general manager of the company designed the plans and arrangement of the buildings. Pig iron and coke are delivered by railroad to a storage yard provided at the same level as the charging platform. This feature eliminates the necessity of installing elevators. The center of the building is less than 30 feet from the cupola spout and melted iron is delivered to this point by means of overhead cranes. At this point the ladles are picked up by two 6-ton cranes traversing the entire length of the main building and by two 3-ton cranes covering the side bays in the same manner. The same cranes are employed to deliver the castings to the cleaning rooms which are located at the opposite end of the building from the cupola. With the exception of a length of 80 feet no back travel is necessary from the melting point to the loading point of the finished castings. The molding equipment includes 10 machines made by the Osborn Mfg. Co., Cleveland.

Will Preserve Workshop of James Watt

An interesting question has arisen as a sequel to the death of George Tangye, the founder of Tangyes, Ltd. Mr. Tangye resided at Heathfield Hall, about three miles from Birmingham, for many years the residence of James Watt. The inventor of the steam engine has a workshop in an upper story where he was accustomed to spend a great deal of his time, and which was left and sacredly preserved by Mr. Tangye exactly as it was when Watt died with the various tools lying just as he left them. The Watt centenary committee has decided to include among its objects the preservation of the relics of the hall as a national memorial. This garret workshop has been untouched for over 100 years, and it is proposed to take such steps as will preserve it for the nation. It is explained, however, that further funds will be required for the purpose, and an appeal is now made for financial support to secure this object. The headquarters of the committee is the chamber of commerce, New street, Birmingham, Eng.

Choose Site for Building

A site for the new building in Washington, which is to serve as a home for the National Academy of Sciences and the National Research council recently has been obtained. It comprises the entire block bounded by B and C streets and Twenty-first and Twenty-second streets, northwest, and faces the Lincoln memorial in Potomac park.

Investigates Steel Sand Properties

Benefit to Castings Secured by Scientific Study of Molding Materials—Sample Mixtures Tested in the Laboratory Indicate Whether a Sand or Clay Is Satisfactory Before It Is Used

BY R. L. LINDSTROM

OBTAINING the very highest quality of materials commensurate with the purpose for which they are required, is conceded to be good practice by manufacturers who must strive for both quality and production. This practice generally results in a lower ultimate cost, which is especially true in the purchase of molding materials on which the cost of freight is sometimes as great or greater than the cost of the material purchased.

Apparently there has been but little work done in developing standards or specifications by which these materials may be purchased, the most reliable guide having been the results obtained in shop practice. It is quite difficult for steel foundries which use several thousand tons of sand and clay each month in the preparation of facing-sand mixtures, to ascertain the real results of running in a carload or two of an untried sand or clay, and they are generally reluctant in trying a larger quantity because of the danger of spoiling the sand heap with unsatisfactory material before the results of using the new material can be determined.

It was to overcome this difficulty that a study of these materials was made in the laboratory and the results obtained have given a good idea in advance of what will be the results in the shop. The primary idea was to keep all tests as comparable with shop practice as possible, and, due largely to this, we have never judged a clay or sand but what shop practice has borne out the laboratory results.

Plastic fireclays are used extensively in sand mixtures for molds for steel castings, especially for green-sand mold making. The object of the clay is to act as a bonding material for the highly refractory silica sand. It is folly to buy a high grade sand and mix this with a clay which is low in bonding power, which necessitates the use of such a high percentage of clay that the voids between the sand grains are filled and the natural vent is destroyed. This is certainly one of the reasons for poor finish on castings. It is also poor practice to buy a clay having a low softening point in order to obtain great plasticity or bonding power, for even though this will allow a lower percentage of clay to be used, it is liable to bake to a hard mass at pouring temperatures, causing high sand loss and extra cleaning room costs.

Clay Qualities Sought

The ideal clay is one having both high bonding power, so that the smallest possible amount can be used, and a high softening point. It is sometimes difficult to find clays having both these valuable properties, but the appearance of the castings, ease of cleaning, etc., justify the effort.

The first test made on clay was on the bonding power, and as this varies with the moisture content, the pressure applied in mixing with the sand, kind of sand, etc., the following practice was followed:

Dry Ottawa, Ill., sand is used as a base for all tests as this is found to vary but little in fineness. Seven hundred grams of this sand is thoroughly mixed with 70 grams of the sample by rolling together on glazed paper. Sufficient water —25 cubic centimeters is generally required—is then added so that the mixture will just adhere to the palm of the hand. This is then kneaded for exactly two minutes in the same manner as pat tests are made in a cement testing laboratory. It is then allowed to stand for 12 hours in a covered receptacle in order to develop its maximum bond. It is found by actual test that the bond increases considerably in 12 hours and but slightly after that time.

The object of using 10 per cent of clay and kneading for two minutes is to obtain a bond which is comparable with the mixture run in the mill for two minutes with only 5 per cent clay.

The mixture is then placed in the core box shown in Fig. 19 and struck off evenly. To eliminate the errors of uneven tamping, the tamping block shown to the right of the picture, was made. With this block it is possible to evenly compress the volume of sand which is 1 x 2 x 12 inches into a core which is exactly 1 x 1 x 12 inches. This core is then placed on a glass plate in the usual way and gently pushed lengthwise over the plate until it breaks off. The length of the portion of the bar breaking off is the bonding strength of the mixture.

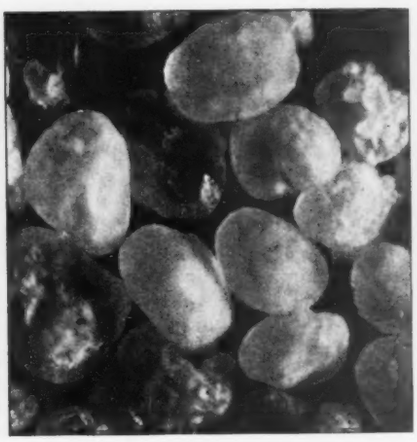


FIG. 1—NO. 1 SAND, 40 MESH

FIG. 2—NO. 1 SAND, 60 MESH

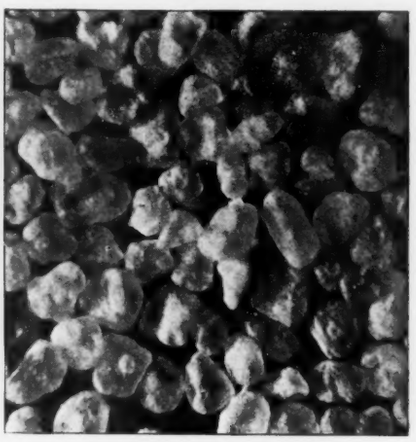


FIG. 3—NO. 1 SAND, 80 MESH

Paper read at the convention of the American Foundrymen's association, Columbus, O., Oct. 5, 1920, by R. L. Lindstrom, Canadian Steel Foundries, Ltd., Montreal, Can.

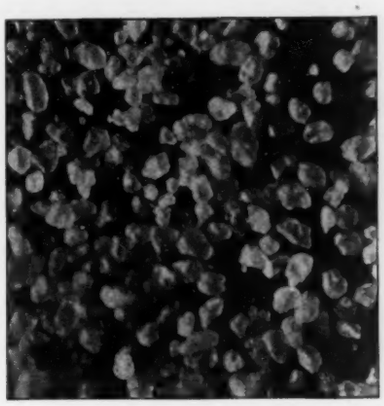


FIG. 4—NO. 1 SAND, 100 MESH

FIG. 5—NO. 2 SAND, 40 MESH

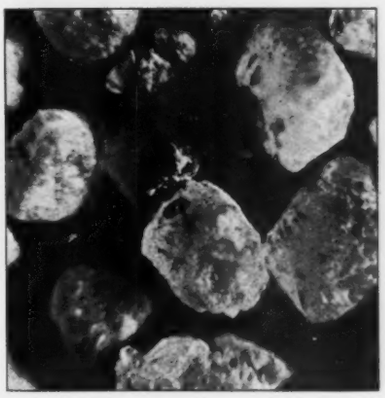


FIG. 6—NO. 3 SAND

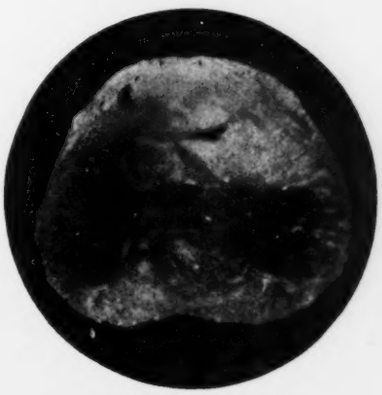


FIG. 7—NO. 1 SAND

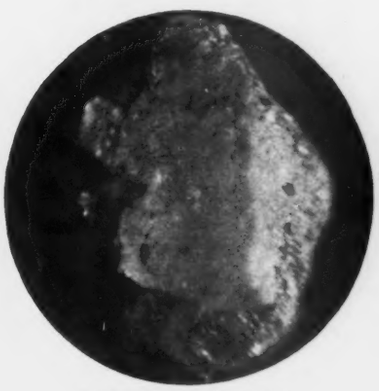


FIG. 8—NO. 2 SAND

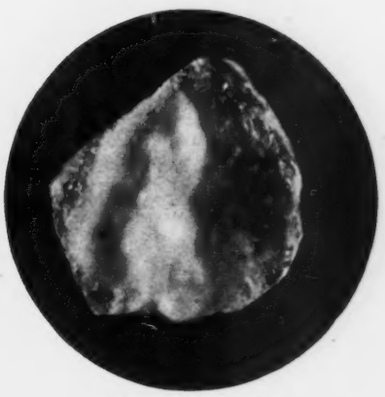


FIG. 9—NO. 4 SAND

FIG. 10—NO. 5 SAND

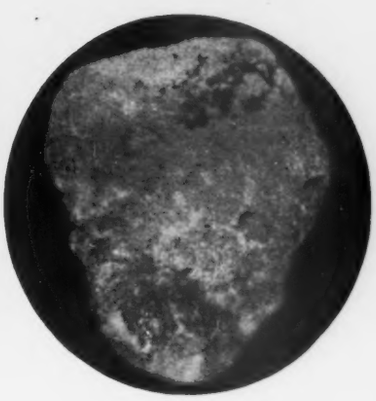


FIG. 11—NO. 6 SAND

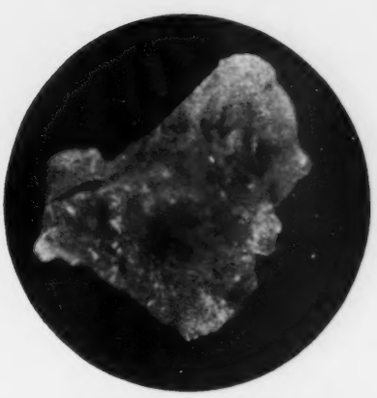


FIG. 12—NO. 7 SAND

FIG. 13—NO. 4 SAND 40 MESH

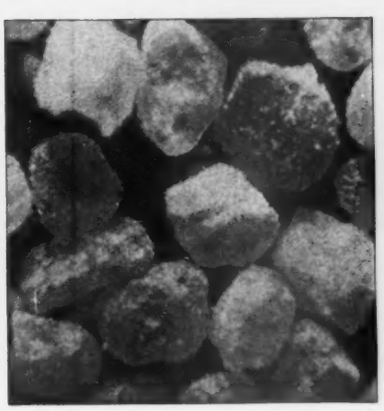


FIG. 14—NO. 5 SAND, 40 MESH

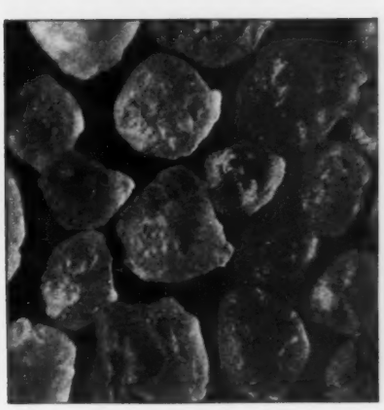


FIG. 15—NO. 6 SAND, 40 MESH

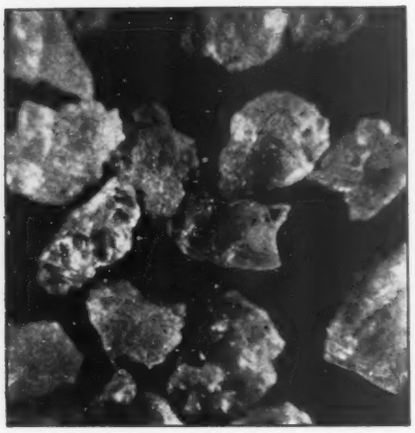


FIG. 16—NO. 7 SAND, 40 MESH

For the purpose of easy comparison, a core which projects over the plate 3 inches before breaking is stated to have a plasticity of 100.

By this method of testing results were obtained on over 50 different clays sold for foundry facing which had a range of from 52 to 112 plasticity. No clay is considered which has a plasticity below 85, as its use in the shop is not satisfactory.

The fusion points, or rather softening points are made in a resistance furnace in the usual manner, and no clay having a softening point below 1600 degrees Cent. (2912 degrees Fahr.) is considered good.

Fig. 17 shows comparisons of different foundry facing mixtures. This illustration indicates a marked difference in the strength of various clays, in a manner which is very positive. By the use of clays, *a, b, or c* we have been able to cut our clay consumption over 50 per cent of what was used before testing was started, and obtained a much nicer finish on the castings with less labor in the cleaning room in removing the sand.

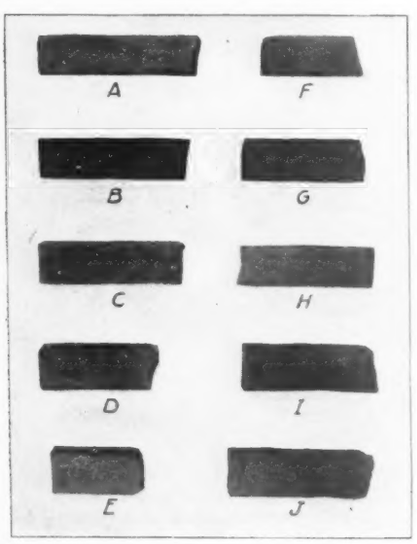


FIG. 17—COMPARISON OF FOUNDRY FACING MIXTURES

Foilowing is a list of some of the clays tested showing the softening points and bond tests of clays from various sources. This shows a range of result too great to allow indiscriminate purchasing, if best results are expected from the foundry.

Clay	State	Plasticity Per cent	Melting Point Degrees Fahr.
1	New Jersey	119	3090
2	Pennsylvania	108	2730
3	New Jersey	106	3030
4	Missouri	100	3182
5	New Jersey	100	2950
6	Ohio	92	2790
7	Missouri	92	3040
8	Pennsylvania	92	2890
9	Pennsylvania	92	3020
10	Missouri	92	3020
11	Ohio	92	2820
12	Ohio	90	2760
13	Pennsylvania	85	2760
14	Virginia	84	3020
15		79	3040
16	Ohio	84	
17	Ohio	82	
18	Ohio	80	
19	Pennsylvania	79	
20	Indiana	78	
21	Pennsylvania	77	
22	Pennsylvania	75	
23	Ohio	73	
24	Pennsylvania	71	
25		70	
26	Pennsylvania	69	
27	Ohio	67	
28	Ohio	67	
29	Pennsylvania	Very Poor	
30	Ohio	Very Poor	

Fineness of clay is important for foundry work, as a much stronger, smoother facing will almost invariably be obtained with a very fine clay.

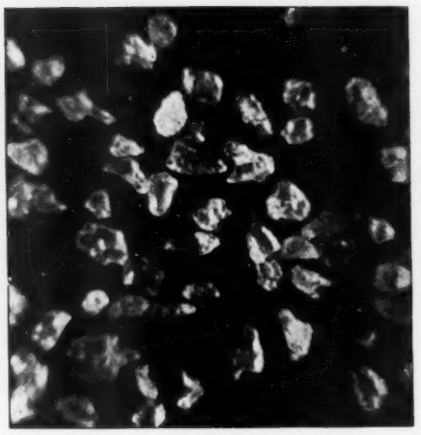


FIG. 18—NO. 7 SAND, SHOWING ANGULAR PARTICLES

tests and the microscope. The sand must be refractory and therefore the silica content must be as high as possible. The screen tests are important in order to determine the venting properties. Uniformity of size is certainly an important feature because the more uniform the size of the grains, the more open the sand will be. The accompanying table gives the screen test and silica content on seven silica sands from different sources.

Sand No. 2 which has 81 per cent remaining on a 40-inch screen was found to have the best venting properties. This sand also has the highest total percentage remaining on a 60-mesh screen.

Screen Tests and Silica Content of Sands

No.	State	Mesh	Fineness 20	40	60	80	100	100X	Total on 60 mesh	Silica content
1	Illinois		10.75	33.6	44.02	.37	2.41	5.62	88.34	97.25
2	Pennsylvania		8.00	81.0	7.5	1.5	.5	1.5	96.5	97.25
3	Ohio		19.0	29.0	33.0	14.0	2.5	2.5	81.0	97.40
4	Ohio		29.2	51.8	12.2	3.4	.9	2.5	93.2	96.52
5	New Jersey		11.0	17.4	25.6	19.5	10.2	15.0	54.9	97.00
6	Ontario		2.1	62.8	26.4	6.9	.7	.8	91.6	93.97
7	Quebec		1.6	25.8	33.1	27.4	5.6	6.5	61.5	97.79

It is quite difficult to break up large particles of clay in the milling machine, and they generally flatten out and have a tendency to scab the casting.

A specification for foundry clay could perhaps be worked up along the following lines:

Plasticity test: Not less than 85.

Softening point: Not less than 1,600 degrees Cent.

Fineness test: Not less than 5 per cent shall remain on a 20-mesh sieve and not more than 75 per cent on a 100-mesh.

There should be no difficulty in obtaining a clay, having this fineness when calling for a fine ground clay.

The chemical analysis is not considered at all because it seems impossible to properly interpret the analysis in the same positive manner as the tests for physical properties. Two clays of approximately the same analysis will show entirely different fusion points and plasticity.

Sand is tested in the laboratory by means of chemical analysis, screen

An ideal size of sand grain for average green sand molding would be 100 per cent on a 40-mesh screen, but as this is impossible, we have adopted the standard of 85 per cent for the 20, 40 and 60 mesh-screens. This gives a fairly good field to pick from of those sands having reasonably good venting properties.

The study of sands under the microscope is interesting, and a good idea of the quality of the material can be obtained in this way. The illustrations shown here were taken primarily to show the shape of the grains.

Sand No. 1 is shown in Figs. 1, 2, 3 and 4, showing the 40, 60, 80 and 100 mesh respectively. Even the finest grains are well rounded. Fig. 7 shows a single grain of the same sand more highly magnified, the idea being to show more clearly the details of the

grain. This sand is used quite extensively.

Sand No. 2 is shown in Figs. 5 and 8. This is not as well rounded as No. 1 but is used very successfully, perhaps because of its great uniformity.

Sand No. 3 is shown in Fig. 6. The main difference between this and No. 2 is the screen test. If this sand was properly screened it would perhaps be as popular as No. 2.

Sand No. 4 is shown in Figs. 9 and 13. The grains are well rounded and uniform in size. This sand is used extensively, especially by the advocates of coarse sand.

Sand No. 5 is shown in Figs. 10 and 14. The shape of the grains is good; they have particles of fine sand adhering to them. This is also successfully used.

Sand No. 6 is shown in Figs. 11 and 15, and is being used successfully in an experimental way.

Sand No. 7 is shown in Figs. 12, 16 and 18. This group is interesting, due to the fact that the sand is not fit for foundry use and the pictures evidently show the reason why. Several hundred tons of this sand were used, during a shortage of our regular sand, and the results in the shop were anything but satisfactory. The grains are not rounded, but angular, and split quite readily into smaller angular particles, as shown in Fig. 18. It packs together into nearly a solid mass when rammed, leaving little or no vent, and consequently the steel will not lay quietly upon it.

This may be the reason why there are so many silica sands which are not suitable for steel foundry work.

It would seem that there is a vast field for real research on sand and clay for the specific use of steel, especially today, when the customer is demanding cleaner castings than formerly.

Production of Manganese Shows Decrease

A preliminary statement of the production of manganese in the United States in 1919 and of the general present conditions of the industry has just been compiled under the direction of H. A. C. Jenison, of the United States geological survey, department of the interior. The general decline in the domestic production of high-grade manganese ore, which began early in 1919, continued throughout the year. During the last quarter the shipments of high-grade ore containing 35 per cent or more of manganese amounted to only 4069 long tons. Most of this ore was shipped from Montana. During the same period the shipments of manganiferous ore containing .10 to 35 per cent of manganese amounted to 120,243 long tons. Of this quantity about 96,221 tons came from Minnesota, 18,240 tons from Nevada, 3,965 tons from Michigan, and 1000 tons from Virginia. The shipments of ore containing 5 to 10 per cent of manganese amounted to 24,921 tons, of which 24,597 tons came from Minnesota.

The decline in imports that was noted during the summer of 1919 continued through the last quarter of that year, and the first two months of 1920 is marked by a further decline.

In spite of the decline in the domestic production and in the imports of manganese the production of steel during the last few months has been made possible through the utilization of the stocks that accumulated during the period of large production. These stocks were sufficient to meet the requirements of the steel industry for several months without further imports or domestic production.

The reduction of the stocks has been accompanied by an increase in the price of nearly all grades of manganese ore and alloys, but, contrary to what might be expected, this increase in price has only slightly affected the domestic production, and imports have declined still further.

According to the United States shipping board, there has been no shortage of ships nor is there any likelihood that there will be, and the freight rates on imported manganese ore have decreased rather than increased. According to the best information available there has been no shortage of labor in the manganese-producing countries and, except in Russia, no apparent reason for the decrease in the export of ores to the United States.

The practical discontinuance of imports and the almost negligible domestic production has enabled the holders of stocks to dispose of them at increasingly favorable prices. Large importation of foreign ore and alloys will no doubt be resumed when the stocks held in this country are sufficiently reduced.

Sand for Cylinder Cores

Question—Can you please supply us with a core mixture for making cores for cylinder water jackets telling us the nature of the sands so that we can select them from the supply available in New Zealand.

Answer—We would recommend a silica sand free from loam, such as a lake sand or sea sand, for the cores. All lake sands are not adapted for this purpose, as some contain shale or other ingredients which make them easily fusible. Therefore, it would be necessary for you to make a trial before deciding upon the sand you wish to use. If a sea sand is used it would be preferable to have the sand washed before using it. This, however, is not always done and satisfactory results may be obtained without washing it.

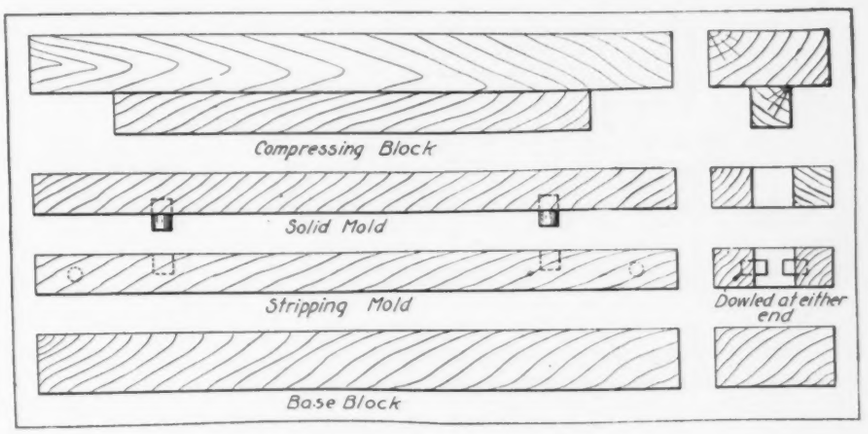


FIG. 19—COMPRESSING MOLD FOR TEST BARS

The sand should be mixed with an oil binder. Plain raw linseed oil is sometimes used but more economy is obtained by a prepared core oil, a number of which are on the market. These binders work well when mixed with as much as 80 parts sand to 1 part oil.

We do not know whether you are familiar with the use of core driers, which is a common practice in America. These driers are cast-iron forms shaped according to the outline of the core. The drag half of the core is made in the core box. A board is placed on top of it and the whole turned over, after which the core box is removed. The drier is then placed on top of the drag half of the core and the board turned over. The drag half of the core is now in the drier and the cope half is placed on top of it. The core is then put in the oven on the drier.

Steel Foundry Cleaning Problems

Work Should Be Systematically Routed—Main Divisions Recommended—Flogging, Sandblasting, Flame Cutting of Risers, Welding, Annealing, Sawing Risers, Chipping, Grinding Described—Piece-rate Pays

BY A. W. GREGG

IN the majority of steel foundries it costs as much or more to clean the castings and prepare them for the shipping platform as it does for the molding and coremaking. The finishing department is usually a source of continual worry to the foundry superintendent and is the place where delays are most apt to occur. It is easier to get a casting molded and poured than it is to get it through the finishing department, but in many shops there is a tendency to feel that the job is out as soon as the molds are poured, in spite of the fact that an uncleaned casting is of no more use to the machine shop or customer than the mold in which it was cast.

Probably the greatest problem which the finishing department is called upon to solve lies in securing labor. Fortunately, the machinery in the modern chipping room is infinitely better than it was 10 or 15 years ago. Lighting, heating and ventilation in a great many foundries have not received the attention which their importance merits, but it is more generally recognized every day that the foundry should not be, and is not necessarily, a dirty, dusty, ill-lighted place where a man works because he cannot find any more congenial occupation.

The kind of floor and the method of transportation for castings in the finishing department require careful study. In this connection the class of work is the important factor to be considered. Where the work is light enough to be handled by hand, creosoted wood block makes the best floor which can be put down. With a good floor it is possible to use the lifting truck for transportation and this is the neatest and cheapest method which has ever been devised for handling small steel castings. Where heavy castings are produced they must be handled with a crane and the floor in this case is not of such great importance.

Proper organization demands that departmental lines be strictly drawn in a steel foundry of any size. Following the natural classification of the work, the operating departments are: the metal department; the molding and coremaking departments; and the finishing department.

The system of subdividing the work should be followed in each department, and a great deal of confusion and waste of labor is avoided if a definite plan of operations be adopted. Especially is this true of the finishing department which at its best appears to the layman as a disorderly place, and perhaps a good many of them are open to this reproach. One steel foundry with which the author is familiar adheres so rigidly to a definite plan of operation that all castings are put through the sandblast whether necessary or not; the claim being that it is less expensive to sandblast than to sort out and short-cut the occasional castings which peel sufficiently clean to make the sand blast operation unnecessary.

Routing of Work

It is impossible to lay out a system of routing which will be best for all conditions, but the following probably will satisfactorily meet the conditions found in most steel foundries. We will assume that the molding department is held responsible to shake out the castings, knock off the loose sand, and deliver them to a definite location in the finishing department.

First operation. Flogging. Gates and light risers are broken off with a sledge, first being nicked with a chipping hammer. Large cores are knocked out or loosened up on the flogging floor preferably with a heavy pneumatic chipping hammer used with a long chisel. If the castings are light enough to be handled by hand a power sprue cutter is a great labor saver. The gates and scrap which accumulate from the flogging operation and the sprue cutter should not be thrown upon the floor, but collected in boxes. If a charging machine is used at the furnaces, the charging boxes should be used, if not, dump buckets which can be handled by the crane and readily transferred to the stock yard or charging platform are serviceable. This saves one handling of scrap material and prevents a mussy accumulation which is a waste of floor space.

Second operation. Sandblasting. The sandblast equipment should be carefully selected to conform to the class of work. Great improvements have been made in sandblasting machinery in the last few years and the foundry now has a selection of several different types adapted for light or heavy work. All modern sandblast rooms have an exhaust system which changes the air four to five times per minute. The sand falls through the grating in the floor, is automatically elevated, screened and returned to the pressure tank. It is important to secure the proper quality of sand, and attention should be given to the use of the proper sized nozzle. Compressed air is expensive and its consumption should be carefully watched.

Third operation. Flame cutting risers. After sandblasting the risers are removed with the flame cutter. The oxy-acetylene torch is used almost universally for cutting risers and heavy gates from steel castings. This can become a very expensive operation if the consumption of oxygen and acetylene is not given careful attention. The natural tendency of the operator is to use a larger tip and a higher pressure on the gas than is necessary, for this makes the cutting easier and more rapid. A small bonus to the operator based on economy in the consumption of gas is usually beneficial. Some foundries prefer to cut the risers from castings before sandblasting to economize room on the sandblast car or table. When this is done a chipper must remove the sand where the cutting is to be done, as the operation of the torch is interfered with by the sand adhering to the risers.

Fourth operation. Welding. If welding is necessary it should be done at this point. The electric arc welder and the oxy-acetylene welding outfit are to be found in most steel foundries, although not given especial prominence when visitors are taken through the shop. The electric weld is made more rapidly and at considerably less cost than the gas weld, although the gas weld when carefully made is considered somewhat more reliable. No welding should be allowed except by instructions from the inspection department and should always be followed by annealing to remove internal strains caused by the high local heat of welding.

Fifth operation. Annealing. The castings are now ready for the annealing furnace. Practically all foundries are now using oil-fired annealing furnaces

A paper read at the convention of the American Foundrymen's association, Columbus, O., Oct. 6, 1920, by A. W. Gregg, Whiting Foundry Equipment Co., Harvey, Ill.

of the car type, although coal and gas-fired furnaces are in use in many foundries and powdered coal and producer gas are used to some extent. All steel castings without exception should be annealed, and the proper temperature, length of time and manner of cooling should be adapted to the composition of the steel under the supervision of a competent metallurgist. A reliable pyrometer installation is essential. The use of cast-iron or steel grids increases the capacity of the annealing furnace by allowing the castings to be unloaded while still too hot to be handled in any other way, and the next charge being ready on another set of grids allows the furnace to be recharged at once, thereby saving considerable fuel. Careful attention to the type of oil burner and economy in the use of oil is very essential in these days of high priced fuel. The annealing furnace should be so designed that the flame does not impinge directly on the castings and so that it is possible to heat uniformly all parts of the annealing furnace. An oxidizing flame should be avoided as it causes excessive scaling.

Sixth operation. Sawing risers. This operation has been eliminated by the flame cutter in the majority of foundries, but where heavy castings with large risers are produced saws are used for their removal. When this is the case the risers are sawed off after annealing. This is especially necessary where high-carbon or alloy steel castings are manufactured. When the flame cutter is used the risers are removed before annealing to economize room and oil in the annealing operation.

Seventh operation. Chipping. The castings are next delivered to the chippers who remove the fins and lumps with pneumatic chipping hammers. Small castings are chipped on benches equipped with vises to hold the work in place. Larger castings are chipped on the floor or on horses.

Steel Foundry Cleaning Problems

Eighth operation. Grinding. The lumps usually left where the risers have been burned or sawed off, and where the gates have been broken, are removed on the grinders. Swing grinders are essential for large castings and stand grinders are used for the lighter work. In order to economize in the use of grinding wheels it is well to have two or three different rates of speed for the grinders, the new wheels being used with the slowest speed and moved to the grinders with higher speeds as the wheels wear down. This also promotes grinding efficiency by maintaining a relatively uniform peripheral speed as the diameter of the wheel is redced in grinding.

Ninth operation. Tumbling. The final operation in the finishing department should be to tumble all castings whose size permits them to go into the tumbling barrel. This removes annealing scale and produces a bright clean surface on the castings. Castings too large for the tumbler should be sandblasted. The tumbler, however, furnishes a much more presentable casting and tumbling is a far cheaper operation than sandblasting. In some foundries where the nature of the work permits, the tumbler can replace sandblasting.

Final Inspection Rigid

The castings are now ready for final inspection, sorting and weighing. Inspection at every operation is a very important part of finishing department work. First inspection should be made on the flogging floor and castings which are obviously defective rejected at this point. It is hardly necessary to state that the inspection department should endeavor to reject imperfect castings before much work has been done upon them. Some defects do not show up until after sandblasting so an inspection is necessary after the castings leave the sandblast. At this point also the castings on which welding is necessary and allowable are marked by the inspector.

The foundry foreman should be constantly in touch with the inspection department and the foreman of the finishing department, not only for information concerning defective castings, but also to study the possibilities of decreasing labor in the finishing department by changes in gating, and the elimination of unnecessary fins, and to observe how the facing is peeling from the castings. It is often cheaper to scrap a casting than to clean it.

Without doubt the finishing department is the most difficult part of the foundry in which to introduce a piecework or bonus system of payment. The amount of work to be done on castings from the same pattern varies from day to day with the condition of the molding and core sands, and the care taken by the molders. Especially in the foundry which produces a wide range of castings is the task of setting rates extremely difficult. The writer has tried day work, premium system, piece work, and various bonus systems. Some conditions demand a combination of all of them. There is no department in the foundry where a system of bonus payment or piece work is so necessary, for the output of a man working day work is invariably doubled when he is given a rate. In the writer's experience, piece work based upon the tonnage of castings handled produces the best results. A liberal rate is better than one which is too close and some flexibility in the rates must be allowed to provide for faulty conditions of facing sand and molding practice which cause extra work in cleaning the castings.

Piece-rate systems of payment in the finishing department have a salutory effect on the molding and coremaking departments, for the chipping room boss will certainly make a first class pest of himself when castings come to him with an unusual amount of fins, scabs or lumps or when the cores are too hard. When the chippers have difficulty to make their day's pay the rest of the shop is sure to hear all about it. When the piece-rate system is introduced it is necessary to tighten up on inspection at once, and the inspector should O. K. the piece workers' earnings.

A finishing department of any size should have its own tool and store room. Grinding wheels, hose, sandblast nozzles, saw teeth, waste and lubricants should be stored here. Very few chippers are capable of properly grinding their own chisels and a supply of ground chisels ready for use should be kept on hand. All pneumatic chipping hammers should be returned to the tool room every night and given a kerosene bath. The cutting torches, regulators and hose should also be stored in the tool room.

Increasing Production on Limited Floor Space

Question—Our foundry floor space is entirely inadequate for our increased production requirements and we should appreciate any suggestions leading to a solution of this problem. We are familiar with the method of stacking the molds two-high with gangways between the double rows. Is there not some way in which these molds can be poured if they are packed closely together and two-high?

Answer—As we understand your question you wish to eliminate all gangways and cover the entire molding floor with snap flask molds stacked two-high. This can be done by placing the molds exactly over each other and pouring the top layer first, one row at a time, then shaking out the molds and pouring a bottom row. These in turn are shaken out before pouring the second top row and so on until the entire floor has been poured. However, the system is not practicel to any extent. It involves too much lifting and shifting of weights, and the men object to it on that account. It also means that twice the usual quantity of sand for a given floor space has to be piled near the benches in the morning and this is another objectionable feature. Furthermore the hurry incident to pouring work under such conditions is bound to result in a considerable per-

centage of spoiled castings. Snap flask molds in which the sprues are near the edges can be stacked two-high and poured conveniently if gangways are provided between every two pairs of rows.

Without knowing all the circumstances we should not presume to advise a definite course of action; but we submit two solutions, either one of which, in our opinion, is better than stacking the molds.

(1) Put up a temporary shelter adjoining your present foundry building to take care of the overflow work. If the conditions warrant such action later can be made permanent with little expense.

(2) Instead of waiting until the floor is covered with molds before commencing to cast, use a smaller cupola and melt continuously all day commencing, say, at 10 o'clock in the morning. By regulating the speed of melting to suit your particular requirements it will be practicable to start pouring at one end of the shop and by the time the other end has been reached the molds on the first floor will have been shaken out and a sufficient number made in their place to take the next ladle of iron. In this way the same floor space is available several times each day. This system is used quite extensively and has worked out in each case to the mutual satisfaction of the management and the men. The molders do nothing but make the molds and set them on the floor. A special gang follows the bull ladle, pours the iron, shakes out the molds and cuts the sand.

Casting Copper Melted in Iron Cupola

T. F. JENNINGS

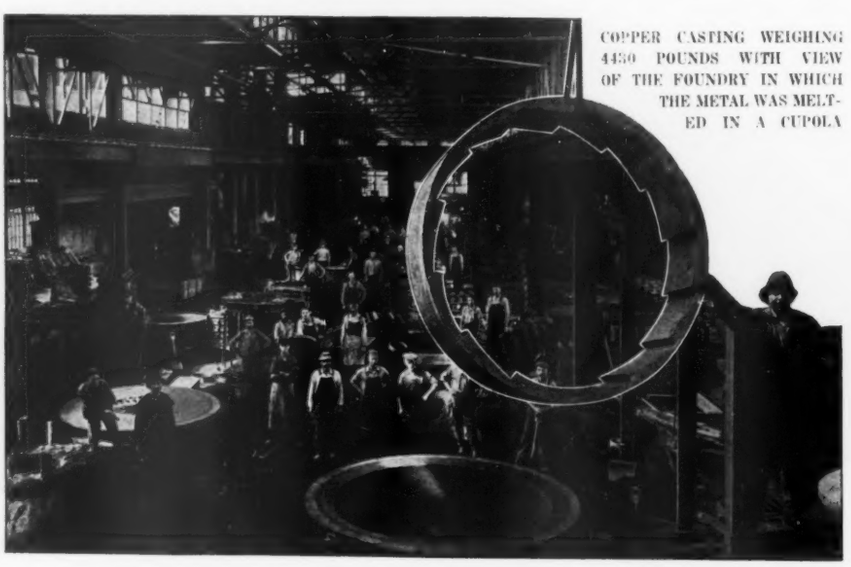
THE difficulty experienced and unsatisfactory results obtained by many foundrymen, in the production of copper castings, during the war period in particular, has created a certain prejudice against the use of the metal, which is entirely unjustified. There is no reason why copper castings cannot be produced just as easily and readily as castings of iron or any other metal, if certain fundamental facts, peculiar to the metal while in the molten state, are observed. For acid resisting purposes it is the opinion of the writer that approximately 50 per cent of the castings made in iron should be made of copper. It is tougher than iron and can be made quite hard.

Sponginess, blowholes, porous or unsound castings together with cold shuts and shrinkage are the usual causes of rejections in the case of copper castings. Occasionally castings of this character may be used; but as a general rule they are unfit for practical use, and if their true character is not discovered before they are placed in service they are liable to cause trouble, expensive delays and perhaps serious accident. Pores or blowholes in castings sometimes are caused by wet or hard molds, or cores; but the principal cause lies in the metal itself, or rather in the method which is adopted while melting and pouring it. In this connection the methods adopted for making the large copper castings in the foundry of the Arthur Plant, of the Utah Copper Co., Garfield, Utah, may be of interest. The casting shown in the insert of the accompanying illustration weighs 4430 pounds. It forms part of an order recently completed for 33 copper and 6 large bronze castings having a total weight of 140,000 pounds. The resources of the purchasing department were tested in gathering up enough scrap copper on the coast to fill this order. In passing, it might be said that the castings were used in the construction of mills employed for the extraction of copper by a new process from a very low grade ore, and incidentally, the results have been 40 per cent better than was expected.

The metal for several of these castings was melted in the regular way in Hawley furnaces operating on oil; but 21 of these castings were so large that it was necessary to melt the metal for them in one of the cupolas, a No. 3 Whiting. The cupola was put up in the usual way, as if for an iron heat, with the exception that only wood free from nails was used to start the fire. A layer of charcoal was charged on top of the coke bed, then the metal charge, 1250 pounds, was added followed by a layer of charcoal. The entire amount for each heat was charged in this manner, which resulted in the metal being protected top and bottom by a layer of charcoal. This arrangement prevented the metal from absorbing sulphur from the coke. A mild blast was employed, about half that used on an iron heat.

The ladle was heated with a torch and about 10 minutes before the furnace was tapped a very small quantity, about ½ per cent, of calcium chloride was placed in the bottom of the ladle. A generous layer of charcoal was put in the bottom of the ladle immediately before the furnace was tapped. Before pouring the casting a deoxidizer consisting of 0.006 per cent by weight of zinc, 0.006 per cent tin and 0.0034 per cent boron product was added to the ladle of metal. This was varied in the case of the last five castings which were made by substituting 1 per cent phosphor copper.

The lip of the ladle was skimmed by throwing a handful of dry sand on at that point and stirring it in with the slag. The force of the pouring stream was eased off just before the mold was filled. After the main runner had set a small piece of phosphor copper about the size of a walnut was dropped into each of the six large risers which were filled with feed metal.



COPPER CASTING WEIGHING 4430 POUNDS WITH VIEW OF THE FOUNDRY IN WHICH THE METAL WAS MELTED IN A CUPOLA

How and Why in Brass Founding

By Charles Vickers

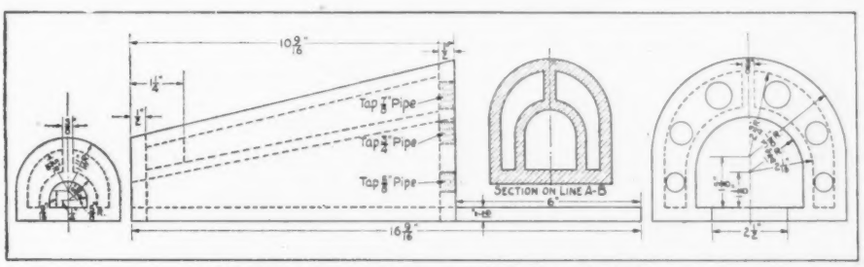
Proper Melting Order for Copper Alloys

We desire to learn in what order the various constituents should be added in the case of the following mixtures; also any information in regard to the successful mixing and casting will be appreciated. The mixtures follow: (1) *Copper,* 88.50 *per cent; tin,* 11.00 *per cent;* 30 *per cent manganese copper,* 0.5 *per cent.* (2) *Copper* 73.50 *per cent; tin,* 12.00 *per cent; lead,* 7.50 *per cent, and* 15 *per cent phosphor copper,* 7 *per cent.* (3) *Copper,* 85.00 *per cent; tin,* 5.00 *per cent; lead,* 5 *per cent, and* 5 *per cent phosphor tin,* 5 *per cent.*

Of course in the case of all three alloys the copper should be melted first, and it should be melted under a cover of charcoal or flux, or both together. This is necessary in any kind of a furnace except electric. In the case of No. 1, mixture, after the copper is melted, add the manganese copper as this is the deoxidizer, and should any difficulty be experienced in running the metal, cut the manganese copper to 0.25 per cent.

No. 2, is a difficult metal to cast. If poured cool so the metal will not cut into either core or mold, it will be almost certain to produce unsound castings. The best way to handle it is to make a dry sand facing with sharp sand and new molding sand, bonded with dextrin. When the mold is finished, spray lightly with molasses water, then coat by painting on plumbago of good grade mixed to a cream with molasses water. Note, for coating green sand molds as above, the molasses must contain no sulphur dioxide. Use the best grade obtainable or simply sugar and water. When coated, bake the molds in the core oven. Have small gates, good-sized risers and pour the molds with hot fluid metal. If properly plumbagoed and dried, the castings will be clean, and the metal will not eat into the sand. If not properly plumbagoed and dried, there will be no casting, only an unsightly mass of metal and sand, for the metal will sink into the mold like water. This alloy can be poured at a temperature that will make smooth castings in a green sand mold, and of course, some of the castings may be good. It has been done, but those skilled in the art have found the greatest economy lies in the use of the dry sand mold properly protected, which means carefully coated and dried.

Alloy No. 3, is not especially difficult to cast, when the copper is melted add the phosphor tin, then the tin, next the lead. In the case of No. 2 alloy, add about 0.25 per cent phosphor copper to the molten copper as a deoxidizer, then the tin and the lead and lastly the balance of the phosphor copper. In this latter case the phosphorus forms part of the alloy.



COPPER TUYERE PRESENTS DIFFICULTIES IN CORING

Venting Is Important

We would like to have a core sand mixture for cores for a copper tuyere, a drawing of which is shown. We have tried a number of mixtures of sand which have not been successful. The last we tried was composed of the following: Old brass sand, 20 parts; new brass sand, 2 parts; silica sand, 2 parts, and pulverized glue, 2 parts.

The trouble with the mixture last used is that it contains too high a percentage of molding sands. The gases cannot get away from such a core, and the remedy is to increase the percentage of sharp sand. Possibly also, some fine cinders could be embedded in the cores to furnish a pathway through which the gases could escape. A core of this type, and especially for copper, must be made with a large percentage of sharp sand, otherwise it will blow, as the gases are held back and force their way through the liquid metal.

It is a good practice to have the sands dry and to weigh them as follows: Silica sand, 6 pounds; No. 2 molding sand, 2 pounds; linseed oil compound, 3 fluid ounces. The above is a weak sand when green, but it will make sound castings. The cores in question would require to be dried on beds of molding sand to keep them in shape, or dryers could be used. To mix the sand, rub the oil with the dried sands, then add sufficient water to give the required plasticity.

Oil has an advantage over glue as a binder for such cores, because oil-bonded sands do not absorb moisture from the molds. It is necessary to have vents as large as permitted by the prints, and to have a nest of small cinders within the core.

Coating Bushing Cores

In coating phosphor bronze bushings we find the metal eats into the sand of the core. We are using a linseed oil bonded sand; a mixture of 1 *oil to* 50 *sand, and the cores are coated with a clay wash and then with plumbago. Is this condition due to the heat of the metal, or is there a better way to wash the cores to eliminate this trouble?*

Phosphor bronze is exceedingly liquid and penetrating. Fortunately it is not as liquid as water, or it would be impossible to hold it within a sand mold, it would soak entirely through. It imitates water to a small degree, and penetrates between the grains of sand, therefore, it is necessary to close the pores between the grains with some refractory substance. If the cores are complicated and have to be dipped, or coated with a brush by painting it is not so easy to protect them. It is necessary to apply several coatings; the first, rather thin, the others creamy. Some prefer to use alundum cement instead of plumbago. It is used by simply mixing with water and painting on or by dipping the cores. A straight, round core is protected best by mixing plumbago to a paste with molasses water. This paste is then to be rubbed over the surface of the core, using the fingers. The plumbago can be polished when dry.

Bronze Foundry Increases Output

Large Nonferrous Foundry Finds It Necessary To Install Increased Melting Equipment To Meet Growing Demands—Oil Fired Furnaces Melt Metal for Ingots and Castings

SEVERAL changes have been effected at the plant of the Bunting Brass & Bronze Co., Toledo, O., since the article describing its new foundry appeared in the December, 1918, issue of THE FOUNDRY. The principal change has been in the melting equipment. The original installation consisted of 32 coke-fired, tilting, crucible furnaces arranged in two rows, one on each side of an exceptionally wide concrete gangway which extended through the center of the shop from one end to the other. Sixteen of these furnaces were built to hold No. 125 or 375-pound pots and the other 16 could accommodate No. 275 or 895-pound crucibles. At the time the plant was placed in operation and for some time afterward the daily charge was in the vicinity of 40,000 pounds. The melt now is 60,000 pounds and when still further changes which are in contemplation are carried into effect, the ultimate daily melt will be 80,000 pounds. This is an enormous output for a nonferrous foundry specializing in bronze bushings and bearings which only weigh a few pounds each. The present melting equipment comprises 12 open-flame, tilting, oil-fired furnaces supplied by the Monarch Engineering & Mfg. Co., Baltimore. Two of these furnaces, one of 3 tons capacity and the other of 1 ton capacity, are used exclusively for melting machine shop borings and washed metal which has been reclaimed from spills in the foundry and from the fins, chips and miscellaneous small scrap gathered up in the cleaning room. The other 10 furnaces are used for melting bronze for the castings. Eight of these furnaces have a capacity of 1300 pounds each to a charge and the other two have a capacity each of 800 pounds. From three to six heats a day are taken out of each furnace. Experiments have been tried to determine the most satisfactory lining and while not complete, indications seem to point to a ganister lining as being the most satisfactory for this type of furnace. Worn spots in the lining are patched while the furnace is in melting position; but when the lining becomes shaky, loose or dangerously thin in places, the furnace body is taken down from the stand, the bolts at the longitudinal parting line removed and each half rolled over on its back. After knocking out the worn material a special form is set into the shell and a new lining of ganister rammed around it and up to the joint line of the shell. Each half is treated in a similar manner and after removing the forms, the lining is thoroughly dried and then the two halves of the furnace are reassembled and lifted back into position on the melting stand.

The chips and borings from the machine shop are collected at regular intervals by a man detailed for that purpose and passed through a magnetic separator which removes any iron or steel adulterations. They then are shoveled into a wide flat pan about 4 x 6 feet, the bottom of which is heated by a number of gas jets. They are kept in the pan and stirred occasionally until the oil and moisture which they absorbed in the machine shop are completely evaporated. From the pan they are taken to storage bins built up against one of the end walls of the foundry in the vicinity

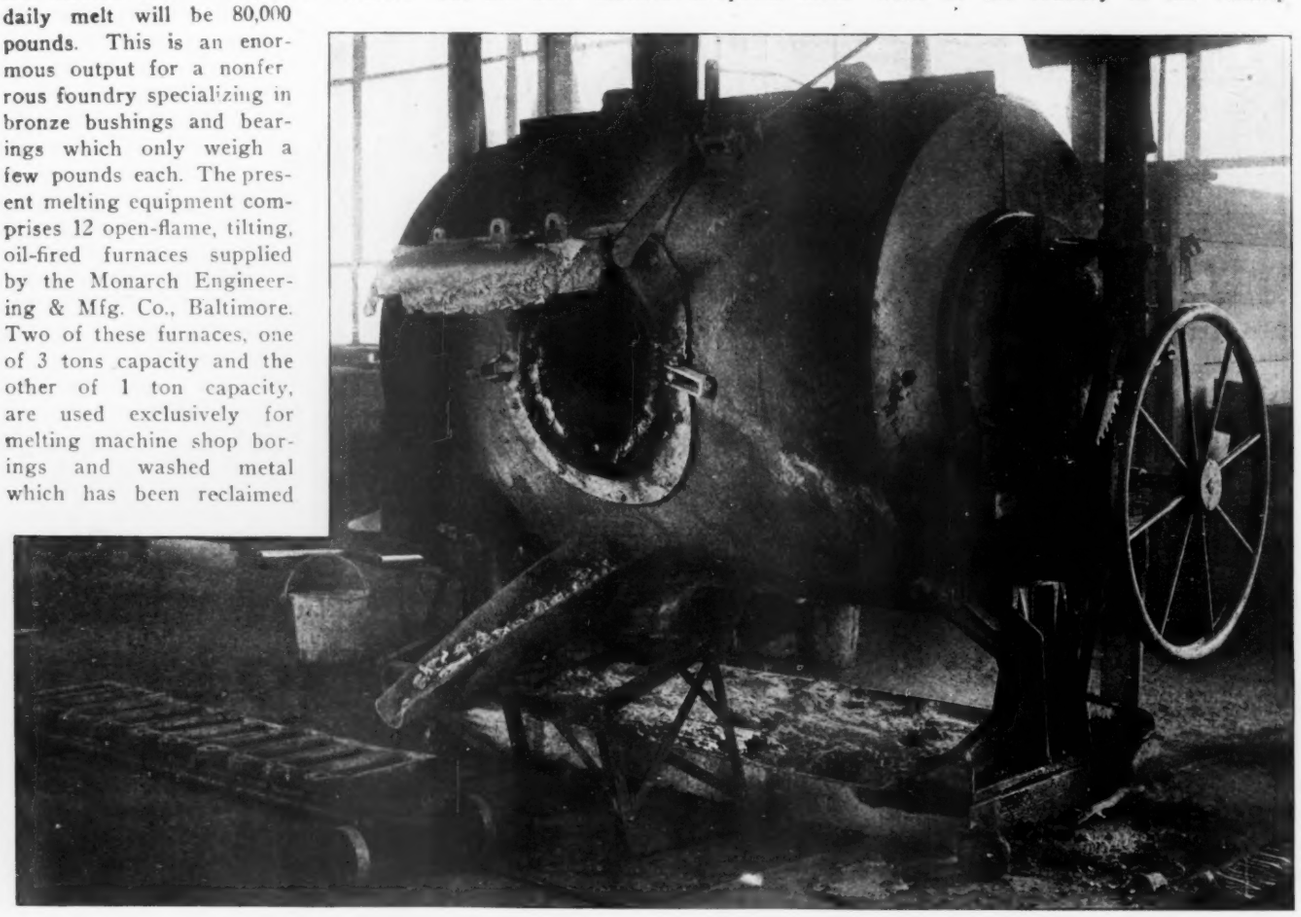


FIG. 1—A LARGE OIL-FIRED FURNACE IS USED EXCLUSIVELY FOR MELTING BORINGS AND RECLAIMED METAL—NOTE THE ADAPTABLE CHARACTER OF THE SPOUT AND THE INGENIOUS TYPE OF INGOT TRUCK

STANDARD SPECIFICATIONS FOR GRAY-IRON CASTINGS

(Concluded from Data Sheet No. 358)

8. (a) Two sets of two arbitration test bars each shall be cast from each melt, one set from the first and the other set from the last iron going into the castings. Where the melt exceeds 20 tons, an additional set of two bars shall be cast for each additional 20 tons or fraction thereof. In case of a change of mixture during the melt, one set of two bars shall also be cast for every mixture other than the regular one. Each set of two bars shall be cast in a single mold.

(b) All arbitration test bars cast shall be tested as specified in section 5 (a).

9. One arbitration test bar of each set cast shall conform to the requirements specified in section 5 (a); otherwise the castings represented by such bars shall be rejected.

IV. Workmanship and Finish

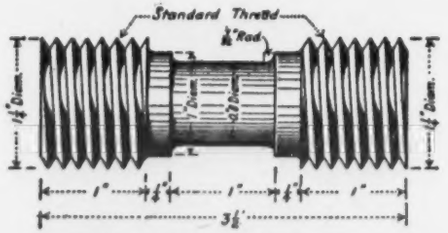


Fig. 2—Tension Test Specimen

10. The castings shall be true to pattern, and free from cracks, flaws and excessive shrinkage. In other respects they shall conform to whatever points may be specially agreed upon between the manufacturer and the purchaser.

V. Inspection

11. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the castings ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

RECOMMENDED PRACTICE FOR ANNEALING CARBON-STEEL CASTINGS*

1. The castings should preferably be sufficiently cleaned of adhering sand before annealing to insure thorough and uniform heating.

2. The castings should be heated slowly and uniformly to temperatures varying with the carbon content of the steel, approximately as follows:

Carbon per cent	Temperature degrees Cent.
Up to 0.16	925
0.16 to 0.34	875
0.35 to 0.54	850
0.55 to 0.79	830

Nothing in these recommendations shall operate against the temperatures aimed at being 50, and in special cases, 100 degrees Cent. higher than those given in the table, when necessary to attain the desired result.

3. The castings should be kept at a maximum temperature a sufficient length of time to insure the refining of the grain. In general, the heavier the sections of the casting, the longer must be the time of exposure to the maximum temperature.

4. (a) The castings should be cooled slowly and uniformly in the furnace, when it is desired that the steel shall possess the maximum softness.

(b) The castings may be cooled at an accelerated rate, when it is desired that the steel possess rather higher tensile strength and elastic limit than can be procured by very slow cooling. This cooling must be so conducted as to leave the steel reasonably free from cooling stresses.

The manner of carrying out this accelerated cooling should be such as will attain the desired result. For instance, the castings may be withdrawn from the furnace and buried in a bed of material that is a poor conductor of heat; or the annealing furnace may be so thrown open that it will cool more rapidly than if left closed. Should the castings be of such uneven section that they cool at unequal rates at various points when the furnace is opened, especially if the carbon of the steel is high, the furnace should be closed after the castings have become black, and their further cooling so retarded that the stresses set up by the unequal rates of cooling are relieved.

*Adopted as standard by the American Society for Testing Materials, 1914.

THE FOUNDRY DATA SHEET, DECEMBER 1, 1920

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

of the furnaces and these classfied.

The small scrap from the foundry floor and cleaning room, mixed as it is with sand and dirt, is shoveled up just as it comes and passed through a concentrator consisting of a revolving screen and a set of riffle plates. The material is dumped into a pocket in the floor from which it is taken by a bucket elevator and discharged into a revolving screen where the larger pieces of metal are caught and afterward discharged through the open end of the screen into a box placed there for that purpose. The sand and light particles of metal pass through the screen and fall upon a corrugated table over which a stream of water is constantly flowing. Owing to the difference in specific gravity the sand is carried all the way across the plate and falls into a trough at the side, while the metal gradually works along the corrugations in the plate, finally discharging over the end into a receptacle set there to receive it. This material also is dried in the pan before it is taken to the storage room.

Wooden platforms resting on skids, some merely flat while others are provided with sides of varying heights, are used for transporting materials from the storage bins to the furnaces. They are picked up and conveyed from place to place by electric lift trucks. The same transfer system is observed all over the plant. The materials in the different departments are loaded in containers of various shapes and transported wherever necessary. The size and shape of the castings made in this plant being nearly of a uniform size lend themselves readily to this method of transportation.

Analyses are made of all the reclaimed metals and with this information available the melter may add what new metals are necessary to bring the mixture up to a predetermined standard. Even with the greatest precaution, a certain amount of foreign matter adheres to this miscellaneous scrap and various fluxing agents are employed to remove it in the shape of slag after the metal has melted. The charge first is melted down and then the furnace is tilted to the pouring position and after the melter has assured himself that the fluxing agents have performed their function the charge is poled to thoroughly stir it and then the slag is scraped off. If it is necessary to raise the temperature of the metal after the cleaning process a few shovelfulls of charcoal are scattered over the bath, the furnace is tilted back to an upright position and the oil turned on for a short time. As far as possible, the large and small furnaces are charged and timed so that they are ready for pouring at different times. By this arrangement one gang of men is able to look after the complete operation of both furnaces.

This is essentially a specialty foundry and special methods have been evolved and placed in successful operation for many of the processes. All of the metal from the two furnaces under consideration is poured into ingots, which afterward form part of the regular charge for pouring the castings. Almost all the castings made are absorbed by the automotive industry and the quality of the metal is held to a strict analysis. Some yellow brass is made of the following analysis: Copper, 62 to 65 per cent; zinc, 32 to 36 per cent; lead, 2 to 4 per cent. However, the greater portion of the output consists of phosphor bronze or red brass. The analysis of the former is copper, 80 per cent; tin, 10 per cent; lead, 10 per cent; phosphorus, 0.05 to 0.25 per cent. The red brass contains copper, 84 to 86 per cent; tin, 5 per cent; zinc, 5 per cent; lead, 5 per cent.

The metal is poured into cast iron ingot molds which hold about 50 pounds each. A low open frame, all steel, 4-wheel truck is used for conveying the molds to and from the furnaces. As soon as the metal is ready to pour, an adjustable spout is attached to the opening in the side of the furnace, the truck holding the molds is wheeled into position and placed so that the first mold is under the spout. The furnace then is tipped sufficiently to pour a small stream which is kept running until all the molds are filled. As each mold is filled the truck is pulled ahead one space and when they are all filled the furnace is rolled back long enough to pull the molds out of the way and substitute a truck load of empties. These trucks are provided with long handles attached to the axles of the front wheels and easily may be manipulated either loaded or empty by one man. The ingots are dumped out of the molds immediately after they have set and therefore a comparatively small number of molds is ample to take care of the output of the two furnaces.

After the charge has melted down in the furnace the slag is scraped off, then the metal is poled and covered with charcoal. The metal is carried from the furnaces to the pouring floors in double shank ladles of the same

FIG. 2—THE MOLDS MADE IN SNAP FLASKS ARE BOUND WITH LIGHT STEEL BANDS WHICH ARE RAMMED UP INSIDE THE FLASK AND REMAIN ON THE MOLD AFTER THE FLASK HAS BEEN REMOVED—MOLDS ARE SET UP IN ROWS ON ELEVATED STANDS FOR CONVENIENCE IN POURING

general type and size as are used in iron foundries, doing light work. A preheater which is simply an oil torch connected to the oil pipe leading to the furnace, is used for heating the ladle before it is used and for keeping it hot between heats. One of these preheaters is situated near each furnace. A covering of charcoal is thrown on top of each ladle of metal immediately after it is filled and before it is picked up and carried away.

To facilitate pouring the metal into the molds, light, strong, permanent stands are situated on each floor extending from the molding machines in the direction of the furnaces. Each stand is made up of three pieces of 3-inch pipe supported on three cast iron bases resting on the floor. Two of the pipes serve as a platform for holding the molds while the third is a brace which gives strength and rigidity to the frame. The frames are about 15 feet long and stand about 15 inches high. Flasks placed on these stands to be poured are at a convenient height for the average man.

Men regularly detailed and trained for the work are employed for carrying the metal from the furnaces to the molding floors. When they reach the floor the molder who made the work takes the pouring end of shank and pours his molds himself. There is a certain knack in pouring metal, especially in light work which it is rather difficult to teach others, and which can only be acquired after considerable practice and a certain knowledge and experience.

The oil furnaces occupy the same relative position as the battery of former coke fired furnaces which they have displaced but owing to their greater capacity or speed in melting whereby 12 units have taken the place of 32, there is more free space between them than there was in the former installation. This feature adds to the general roomy appearance of the shop. The ventilating system which was described at considerable length in the previous article on the shop has not been changed, the air still being drawn from outside into a large tunnel under the central gangway from which it escapes through a number of gratings and by the draft induced by the heat of the furnaces carries the steam and gas out through the openings in the sides of the monitor roof.

The air supply for volatilizing the oil and driving it into the furnaces under pressure is supplied by two fans made by the American Blower Co., Detroit. Each is driven by a 40-horsepower motor made by the Westinghouse Electric Co., Pittsburgh. The

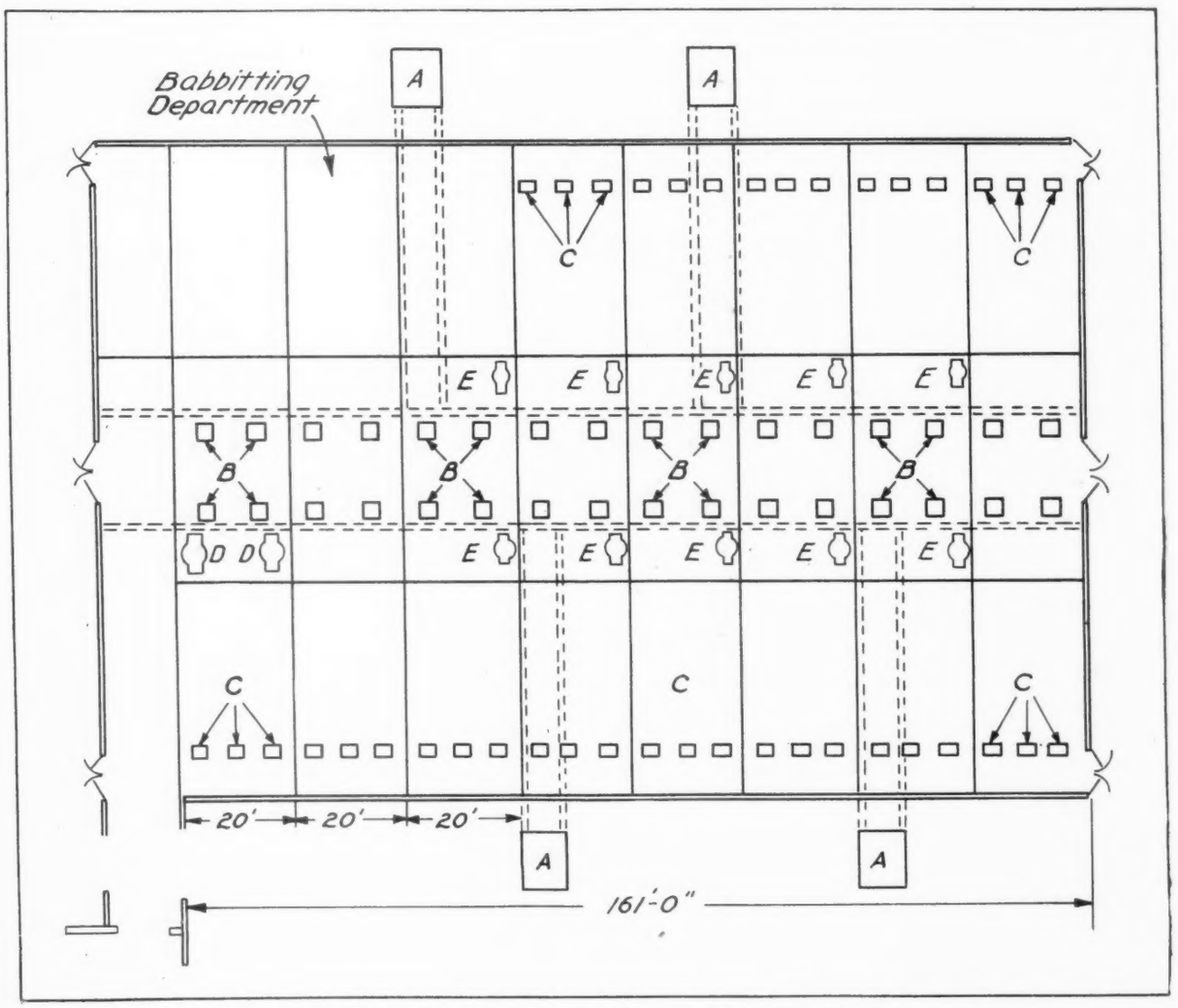


FIG. 3—THE INTAKES FOR THE VENTILATION SYSTEM ARE SHOWN AT *A* ON BOTH SIDES OF THE BUILDING—THE AIR PASSES FROM THE TUNNEL INTO THE FOUNDRY THROUGH THE OPENINGS *B B*—THE POSITION OF THE MOLDING MACHINES IS INDICATED AT *C C*; THE FURNACES FOR MELTING THE BORINGS AT *D D*; AND THE FURNACES FOR MELTING THE REGULAR CHARGES AT *EE*

fans are situated one at each end of the ventilating tunnel and are attached to 10-inch mains which in turn supply small pipes leading to each furnace. The fans are kept running continuously to maintain a certain pressure in the pipes but the supply can be regulated for each furnace by individual valves above the floor level and placed within easy reach of the melter.

Besides the wide gangway extending the full length of the center of the shop and alongside of which the furnaces are situated, a narrow gangway runs around two sides and one end separating the battery of molding machines from the wall. At the present time 38 molding machines supplied by the U. S. Molding Machine Co., Cleveland, are in use. Some of these are the jar-ram type while others are plain power squeezers. The jar-ram machines are used principally on the flasks containing the bushing patterns that are molded on end with green sand cores. Bearings, half liners and many of the bushings are cast horizontally, the latter of course taking dry sand cores.

Most of the molds are made in snap flasks and instead of using slip jackets on the outside of the mold to resist the lateral pressure of the molten metal, light sheet steel bands fitting snugly inside the frame of the snap flask are placed in the flask before the sand. After the mold has been rammed and the flask removed these bands remain on the body of sand and hold it rigidly in position.

A space on the floor near one end about 40 x 50 feet is occupied by equipment for babbitting the bearings. This comprises a furnace for heating the castings, other furnaces for melting the tin and babbitt, and a number of machines of the plunger type developed by the company for depositing an absolutely true babbitt lining.

The core room is equipped with a core sand mixer made by the Blystone Mfg. Co., Cambridge Springs, Pa.; three core machines made by the Wadsworth Core Machine & Equipment Co., Akron, O.; and four ovens supplied by Young Bros., Detroit. Three of the ovens are used for drying cores on racks which are carried in and out by a lift truck and the fourth oven is equipped with long rollers resting on brackets on each side. The cores are made on plates which are afterward placed in this oven by hand. Tumbling barrels supplied by the W. W. Sly Co., Cleveland, and sand blast barrels made by the New Haven Sand Blast Co., New Haven, Conn., are used for cleaning the castings.

Adapt Machine to Soil Pipe Molding

ONE of the jobs which logically should come within the scope of the molding machine manufacturers is the production of soil pipe castings and yet up to the present the subject apparently has received little consideration. Probably the principal reason for this seeming apathy lies in the fact that the present hand operated equipment is singularly efficient and has been developed to a high state of excellence. For these reasons a machine recently developed by the Osborn Mfg. Co., Cleveland, attracts an unusual amount of attention.

The machine, shown in the accompanying illustrations is rigged for the production of soil pipe castings; but may be adapted to the manufacture of any casting which conforms in a general way to the same characteristics, or in other words long narrow castings. Many of the castings of this character are of a comparatively delicate nature with a light or thin metal section and the sand in the mold must be rammed to a definite density to assure success. If the mold is too hard the metal will blow and if the mold is too soft the casting will swell and will be over-weight. The machine under consideration is of the combined jolt-squeeze type and produced molds during the first demonstration at Columbus which apparently were perfect specimens of what molds of that character should be.

Although primarily designed to travel under its own power on a narrow gage track set in concrete flush with the floor it may of course if necessary be operated in a fixed position. The idea underlying the first supposition is that as the sand probably would be prepared in a long wind row by a sand cutting machine, the most efficient method of employing the molding machine would be to start at one end of the floor and gradually work toward the other end consuming the sand and laying down a row of molds during the process. Where a sand conveying system is feasible or where it already is in existence or where for any other reason it is more convenient to operate the machine from a fixed point the traveling mechanism may be disconnected or may be omitted altogether in the construction of the machine.

It is claimed for this machine that under favorable foundry conditions two ordinary workmen can turn out a complete mold in two minutes. It is equipped with an automatic counting device air operated which is adapted to be set to any number of blows from 10 to 75. Once the dial is set the operator pays no more attention to the jolting mechanism. He simply opens the intake valve each time after the flask is filled with sand. When the machine has struck the number of blows indicated on the dial it automatically stops. This feature has a tendency to produce molds that are

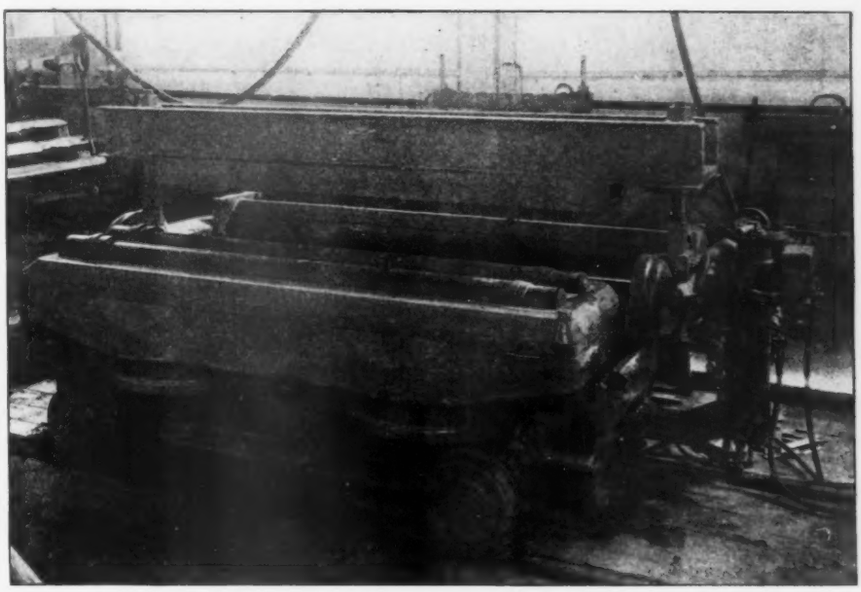


FIG. 1—FRONT VIEW OF MACHINE WITH THE SQUEEZING HEAD PUSHED BACK OUT OF THE WAY

rammed uniformly; to prevent over ramming and unnecessary wear on the equipment. This new type of counting valve recently has been developed and patented by the Osborn Mfg. Co. and may be attached to any of its machines.

As may be noted from the various illustrations, the three operating cylinders forming the foundation of the machine are cast *en bloc*. The two outside cylinders, each 20 inches in diameter are for squeezing the mold while the 9-inch cylinder in the center is employed for jolting it. A rear view of the machine is shown in Fig. 2. The self-propelling machinery

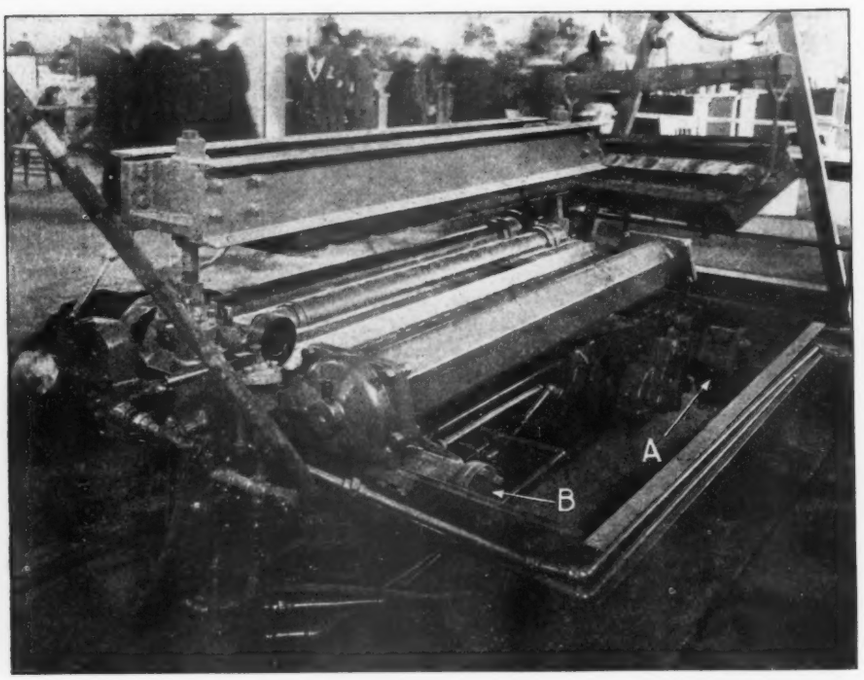


FIG. 2—BACK VIEW SHOWING SQUEEZING HEAD PUSHED FORWARD—THE AIR MOTOR AND ENCLOSED TRAVELING MECHANISM IS SHOWN AT *A* AND THE CYLINDER FOR OPERATING THE STRIPPING MECHANISM IS INDICATED AT *B*

comprising an Ingersoll-Rand air motor and a train of gears, is shown at *A* and the cylinder for operating the stripping mechanism is shown at *B*. The latter functions through a main shaft which in turn raises or depresses the patterns by suitable crank connections.

The squeezing head is made up of two pieces of 9-inch I-beam held together at each end by a casting and supported on a pair of threaded rods by which the height above the mold may be regulated. The entire squeezer head is mounted upon a carriage which travels back and forth on a pair of steel *V*-guides. The wheels of the carriage are provided with roller bearings and the two men operating the machine experience no difficulty in pulling it forward until it reaches the automatic stop which brings it immediately above the mold and insures that the ramming block will register exactly in the flask as is necessary.

Straight side flasks are employed instead of the type with slanting sides usually demanded. They are provided with bars set rather far apart and cut out to allow about 1½ inch clearance around the pattern. This extra clearance seems to have eliminated the usual *soft spots* found under bars which have not been tucked.

In practice the flask is set on the machine, filled with sand and jolted. The squeezing head is then pulled forward and a thin metal straight-edge, attached to the squeezing block, scrapes off the superfluous sand. This straight-edge may be adjusted to varying heights to regulate the quantity of sand which is to be squeezed. The mold is then squeezed, the head pushed back out of the way after which the mold is stripped, lifted off the machine and set on the floor.

Specialize in Foundry Plant Design

A. A. Wickland, formerly connected with the Crane Co., of Chicago, Campbell, Wyant & Cannon Co., of Muskegon, Mich., and other prominent firms, recently returned from a trip through Europe as consulting engineer for a European banking syndicate. His efforts were largely devoted to the development of malleable, gray iron and brass foundries, and the introduction of American machine tools and manufacturing methods. Mr. Wickland is now retained as consulting engineer for several American and European manufacturing concerns. To carry on this work, C. B. Teeter, G. F. Schreiber and others are associated with him under the firm name of A. A. Wickland and Associates, engineers, with office at 105 West Monroe street, Chicago, and are specializing in the layout, architectural design and construction of complete foundries and manufacturing plants. Their further aim will be to apply advanced manufacturing methods, design and introduce equipment and devices essential to promote economical quantity production.

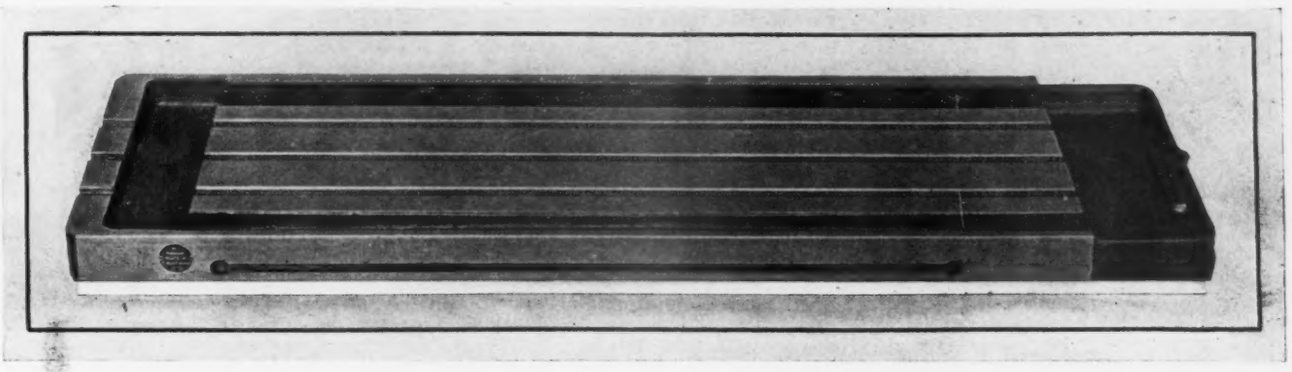
Moves into New Quarters

S. Birkenstein & Sons, Inc. Chicago, dealer in nonferrous metals, has just completed at a cost of over half a million dollars a large new office and warehouse at 1030 to 1056 West North Ave., corner Hawthorn Street and will move into its new quarters on Dec. 1. The new building, four stories in height is built of steel and concrete throughout. Two sidings from the Chicago, Milwaukee and St. Paul railroad allow from 10 to 12 cars to be loaded or unloaded at one time at the concrete loading platform outside the warehouse.

Smelting furnaces and presses for handling the company's product are situated in the basement. Platform scales are located at various points in the building to facilitate handling the material which is conveyed from one floor to the other by three electric elevators, one of 4-tons capacity and two of 3-tons capacity each. The general offices of the company are located on the second floor. Simultaneously with the moving of the Chicago office the Philadelphia offiice will be moved to new quarters at 25th and Ellsworth Streets. The officers of the corporation are: Louis Birkenstein, president; Harry Birkenstein, vice president; Albert Birkenstein, secretary; Milton Birkenstein, treasurer; who together with Jesse Long, manager of the New York office constitute the board of directors.

Will Build New Line of Molding Machines

The W. B. George Foundry Machinery Co., 3933 Colorado avenue, Chicago, is about to bring out a line of split-pattern molding machines for the production of small castings, such as valves and fittings. W. B. George is president of the company and A. W. George is vice president. The concern recently has taken over its present plant, which has been equipped for production of the new line.



Making Milling Machine Tables

BY LEROY M. SHERWIN

THE exacting service requirements for milling machine tables both from the standpoint of quality and workmanship, are very severe. These castings must be made from a good mixture of iron composed of pig iron and scrap of a high grade. They must be close in grain, possessing what is called a steely appearance, must be free from external or internal porosity, they must be hard and yet machinable. They must be capable of taking a fine finish and also of withstanding the great amount of wear, as well as the heavy and severe strain to which they are subjected.

There are three important problems connected with the successful manufacture of castings. First, the pattern; second, the molding, and third, the melting practice, including cupola operation and mixing of metal.

The pattern is so arranged that the mold can be made in two parts, all of the pattern being in the drag portion of the flask. At one time the V-ways and the oil ways were made of green sand but proved unsatisfactory as it was almost impossible to prevent the green sand from cutting and washing. Core prints were afterward placed on the pattern as shown in Fig. 1, and core boxes made. At present all of the table castings have the oil and V-ways cast in cores.

The pattern is made of strips of pine glued solidly, and all outstanding edges are faced with cherry. The core boxes also are made of pine and cherry, with steel strip on all of the surfaces surrounding the openings. This enables the operators to use the boxes often and for a long period of time without making repairs.

The molding, although apparently simple at the present time, has been worked out after considerable thought and experimenting. The mold proper is made of green sand, as is indicated in Figs., 2 and 5. Fig. 2 shows the mold before the cores have been placed, while Fig. 5 shows the cores in position. To be successful with green sand for this class of work, it is necessary to make a careful selection of the molding sands used. The mold is faced with a sand and sea coal mixture composed of New Jersey green molding sand, new, medium molding sand, used molding sand and sea coal. The proportion of sea coal to sand is 1 to 7.

The requirements on castings of this nature are so rigid that it has been claimed they should always be made in dry sand molds. However the defective casting record has been so low on these tables that we are justified in believing that green sand molds are quite satisfactory and much more economical.

One of the rough castings with gates and risers attached is shown in Fig. 3, while Fig. 4 shows the reverse side in which T-slots eventually will be cut. Horn sprues have proved the most satisfactory of any method yet tried for pouring these castings. The molten metal enters the mold through two sprues at each end and coming up through the bottom of the mold fills the interior gradually. The two risers are located equidistant from the center as shown in Fig. 4.

After these castings have been milled and planed on one side, several T-slots are cut from the solid metal as shown in the illustration at the head of this article. Owing to the practice pursued in making the molds and mixing and melting the iron the castings rarely show signs of internal

Abstract of paper presented at the Columbus convention of the American Foundrymen's association, Oct. 4-8. The author, LeRoy M. Sherwin, is connected with the Brown & Sharpe Mfg. Co., Providence, R. I.

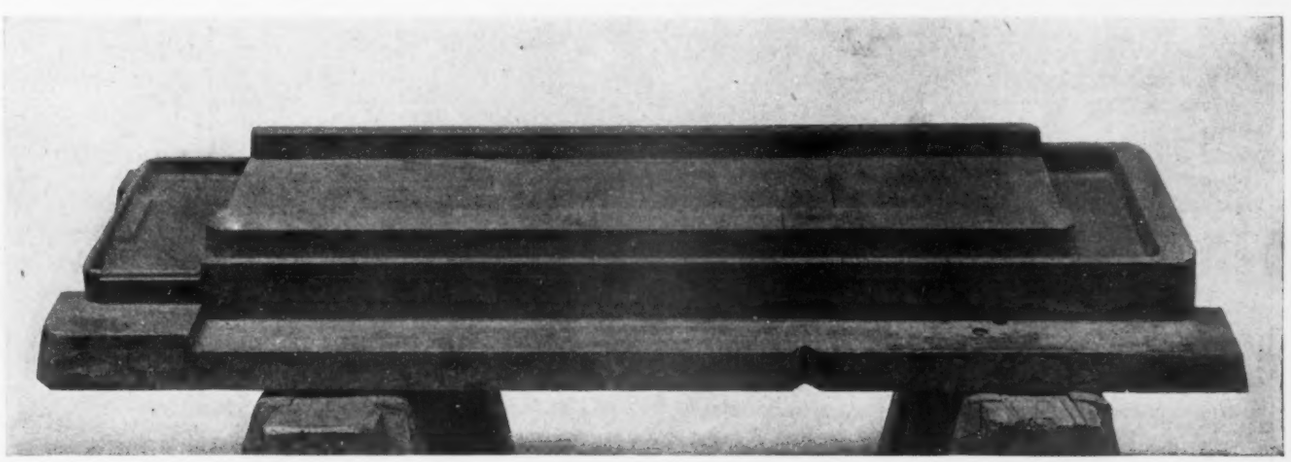


FIG. 1—PATTERN FOR MILLING MACHINE TABLE—CORE PRINTS ON THE SIDES ARE FOR THE V-WAYS

FIG. 2—FLASH AND MOLD FOR MILLING MACHINE TABLE—NOTE THE PROVISION MADE FOR LOOSE HANDLES AT *A*

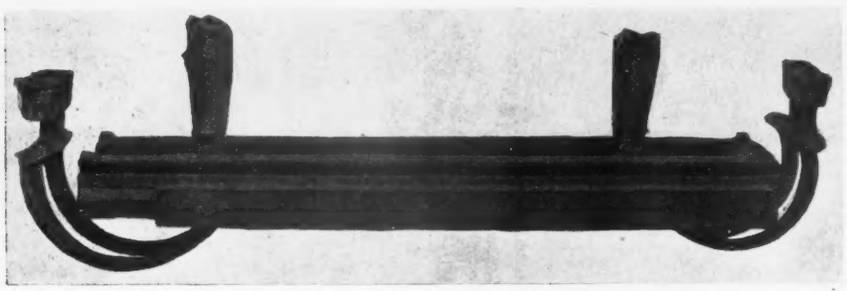


FIG. 3—CASTING WITH GATES AND RISERS ATTACHED

porosity which would be objectionable.

The best grades of coke and pig iron are used in making up the mixtures. An analysis is taken of each car of pig iron and the best is selected and set aside for this purpose. Analyses are also taken of the steel, car wheel and other cast iron scrap.

The charges are held uniform and are made up as follows: One thousand pounds of pig iron comprising 300 pounds eastern Pennsylvania low silicon, 400 northern and 300 southern; 250 pounds of steel scrap, 250 pounds car wheel scrap and 500 pounds of sprues and domestic scrap. This combination seems to work out nicely. About 12½ per cent low carbon steel scrap averaging 0.16 per cent adds strength to the mixture and seems to furnish the most satisfactory results. The car wheels give the mixture an

FIG. 4—FACE SIDE OF THE TABLE

FIG. 5—MOLD WITH CORES IN PLACE IN THE COPE AND DRAG

additional hardness which seems quite necessary. The steel comes in a uniform size and the car wheels are broken to as nearly a uniform size as practical.

A close check is kept on the ultimate analysis and in that way the mixture from day to day is held fairly constant. This is necessary on account of maintaining the hardness on the one hand and the open grain structure on the other. If the iron should be too hard the casting would be chilled and if allowed to go to the machine shop would ruin the high speed milling cutters. The inspection is extremely rigid and castings showing any signs on the outside surface of being porous or open grained are rejected. As will be noticed the castings are finished practically all over.

The cupola in which the iron for the tables is produced is lined to 54 inches inside diameter and melts on an average 10.5 tons an hour. The charging door is located 17 feet above the sand bottom. This has a tendency to allow the waste gas to heat the charge before it reaches the melting zone, thereby increasing the efficiency of the cupola. The tuyeres are nearly continuous and have a ratio of 6 to 1 in comparison to the cross section area of the cupola. The air is delivered to the cupola from a positive pressure blower at the rate of 5300 cubic feet a minute. This figure is checked from time to time by the aid of a blast meter. Another check employed occasionally is to determine the speed at which the blower is running. The revolutions per minute times the amount of air delivered per revolution minus the air loss due to friction, etc., furnishes a ready check on the amount of air being blown.

The coke bed is measured just before adding the last portion. In this way it is possible to gage the amount accurately and maintain the bed approximately 26 inches above the tuyeres.

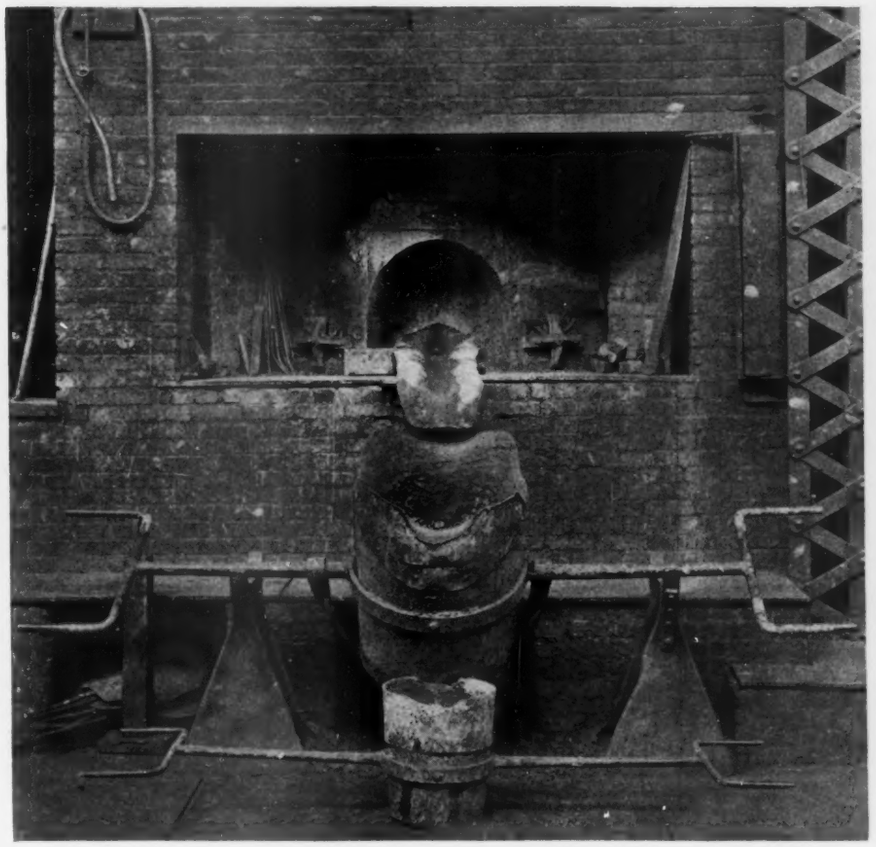


FIG. 7—BESIDES HOLDING THE IRON IN THE CUPOLA AS LONG AS POSSIBLE BEFORE TAPPING, IT IS CAUGHT IN A MIXING LADLE TO SECURE UNIFORMITY

To get the best results with a hard steel mixture it is necessary to add extra coke to the charges, about 350 pounds of coke is being used to melt the charges of 3000 pounds of iron and scrap. This, along with the fact that the cupola, after being charged to the door, is allowed to stand for two hours before the wind is put on, insures good metal at the very beginning of the heat.

The charging floor is exceptionally large and airy, permitting the weighing and the other work in connection with the compounding of the mixtures to be performed with the proper regard for obtaining the best results. Fig. 6 shows a very small portion of the charging floor, but gives an idea of some of the equipment and illustrates a portion of one of the 3000-pound charges. The additional steel is in a wheelbarrow shown at the lower right hand corner of the illustration.

The charging of the cupola is done by hand. The steel scrap is placed on top of the coke and the pig iron then is scattered over the entire area, but not entirely around the lining. The car wheel scrap is distributed around the pig iron, and then the cast iron scrap is placed over these materials.

The analysis of the iron and its physical properties follow:

Analysis of Iron

	Per Cent
Silicon	1.300
Sulphur	0.115
Phosphorus	0.440
Manganese	0.550
Combined Carbon	0.760
Graphite Carbon	2.540
Total Carbon	3.300

Tensile Test—Turned Specimens

Diameter Inches	Area Square Inches	Strength Pounds Per Square Inch
0.799	0.501	36,000

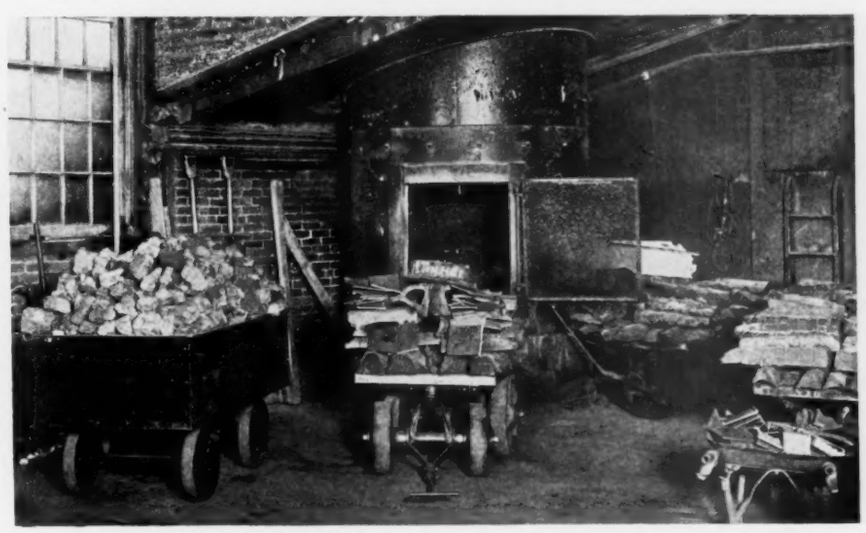


FIG. 6—THE CHARGES ARE ASSEMBLED ON THE TRUCKS IN THE ORDER WHICH THEY GO IN THE CUPOLA, FIRST STEEL, THEN CAR WHEEL AND OTHER SCRAP AND LAST THE PIG IRON

Transverse Test—Central Load

Span	Area	Breaking Load	Modulus of Rupture
inches	square inches	pounds	pounds per Square Inch
12	1.00	3600	64,800
10	1.00	4000	60,000
12	1.20	4000	70,700

The production of good castings is the first consideration and large coke ratios which interfere with this production are not used. Plenty of coke is used to insure hot, clean iron.

All sprues and scrap used in the mixture are rattled, thereby eliminating any clay which adheres to the sprues in the form of burnt sand. All coke is stored in a covered shed to insure a dry coke bed. Most of the pig iron and scrap also are under cover.

At the beginning of the heat as much iron as is practical is accumulated in the basin to help secure a uniformity of the mixture. Most of this mixing, however, is done with the aid of the mixing ladle, which is located beneath the cupola spout as shown in Fig. 7. The molten iron always passes into the mixing ladle before going into the large ladles, or even buil ladles, when they are used.

Safety Methods Increase Shop Output

BY GEORGE A. HART

YEARS ago the problem of production was uppermost in the minds of many engaged in the steel castings industry. The same condition apparently existed in practically all other lines of manufacture, and little attention then was given to safety or wefare as now understood. Protection from accidents was wholly dependent upon the initiative of those in charge.

This condition may have been due to the enormous industrial development of the country at that period, and as steel casting was more or less in its infancy, production was no doubt taxed to the utmost in quantity and quality to meet the requirements of the trade. The foremost men in the industry at that time, undoubtedly, were kindly and humane, but entirely overlooked the important matter of safety. Every effort apparently was given by them to the study and development of improved mechanical and metallurgical methods to increase production and improve quality. They succeeded fairly well but at what now appears as a great sacrifice. Industrial tragedies did not seem to seriously disturb society at that time, as everyone seemed too much engaged in the great commercial development.

Gradually, however, executives began to realize more fully the importance of an efficient working force as a factor in production. Public opinion also began to claim that compensation as required by law, did not help sufficiently to prevent accidents, and insisted on greater measures of protection, with the result that the movement of *safety first* was brought about.

It was soon realized that in order to have this movement successful, the management must fully recognize the importance of it from both the humane and commercial points of view. Safety departments were organized on a modest basis and every effort was made to secure the co-operation of the various shop departments. The results, in a short time, showed activity in safeguarding machinery and other devices, with a view of reducing to a minimum the liability of accident to the workmen.

Among the first companies to establish a safety department was the National Malleable Castings Co., Cleveland. As soon as this department began to function a number of interesting engineering problems appeared which required careful study and sometimes many conferences between the safety engineer and the engineering and production departments. These questions were eventually solved in one manner or another to the mutual satisfaction of all concerned.

Obstacles Surmounted

It is interesting that while the heads of the various departments looked favorably upon the safety movement they were constantly alert to object to any safety device they believe might affect production. Under such conditions production was not permitted to suffer and at the same time accident prevention devices were installed. Of the many problems that arose, a number of them, in addition to securring the safety conditions desired, also led to changes in operating practice, with material improvement in the cost of production. Specific examples of this may be of interest.

It had been the practice, for a number of years, to place the ferromanganese and ferrosilicon additions, required for each heat, in heavy paper bags on a small platform in the vicinity of the spout which carries the molten metal from the furnace to the ladle. Shortly after tapping, the alloys were thrown into the ladle by hand by one of the workmen. He was exposed to the intense heat of the metal, in addition to the liability of falling off the platform, which was not equipped with guards. This practice was considered dangerous for the workmen, and it was found that suitable guards would interfere with adding the alloys in this manner.

After a careful study of the situation, a mechanical device was designed for adding the alloys to the hot metal as it was flowing through the spout to the ladle. The operator of the device is located some distance from the heat and occupies a guarded position where he is perfectly safe and considered more comfortable as compared to the former practice. In addition to securing a safe means of operation, it was found that by adding the alloys in this manner, the amount, of one of the alloys, required to secure the same results in the steel was somewhat less than in the previous dangerous practice. The saving of this one item alone was considerable.

A number of years ago the two steel plants of the company adopted pulverized coal as a fuel in the open-hearth furnaces, which move has been attracting the attention of steel manufacturers in this country and in Europe. While the interest in the use of pulverized coal as fuel in open-hearth furnaces for the production of steel is generally considered by metallurgists from an economic point of view, the humane side was a large factor in causing this method to be considered and finally adopted by the National Malleable Castings Co.

No doubt many are familiar with the disagreeable working conditions of operating a gas-producer plant. The use of powdered coal has replaced all these working conditions with less unpleasant ones and is also more economical than melting with producer gas.

Another safety feature installed at considerable expense a number of years ago, namely, a covered stock house in which the charges for the furnaces are made up and sent forward. While there is a certain amount of economic gain by this arrangement, the employes are benefited in that they can carry on their work with much more comfort than they did previous to the installation of this building. Their exposure to the elements, under the old conditions, led

Paper presented by George A. Hart at a recent meeting of the engineering section of the National Safety Council. Mr. Hart is superintendent, Melrose Park plant, National Malleable Castings Co.

to discomfort and liability to sickness, particularly during the cold winter months Without the improved conditions difficulty would no doubt be experienced now in securing help during the winter season for this particular work. The improved condition under which this work is being performed, appeals to the company as being more humane and, at the same time, of assistance in maintaining production.

Another operation that has been receiving constant attention is the sand blasting of castings. Sandblasting as it is carried on is not, at its best, an attractive job. Many plants have had difficulty and probably are continuing to have difficulty in securing men for this class of work. The National Malleable company has been fully aware of the existence of this hardship for some time and realizes that men cannot work comfortably in a sandblast house for any length of time without being properly protected.

It was deemed that the old-fashioned helmet with a mouthpiece did not afford sufficient protection. After considerable study and experiment a device was developed to take the place of the helmet, that will permit a man to work in safety and with reasonable comfort. This device fits snugly over the face and is supplied with fresh air under pressure The pressure can be regulated by valves to suit the convenience of the operator. It was found that with the use of this equipment in sandblasting the men have been able to increase the output materially over that obtained when using the old helmet and mouthpiece. From these examples it is apparent the various safety features and improvements in production are more or less related.

Service House for Employes

Another phase of safety to which the company has given considerable attention is what might be termed personal welfare and hygiene. A large service house in which steel lockers, shower baths and wash bowls, is provided for the employes as well as medical service. When accidents occur a surgeon is available promptly and the injured employe is returned to work.

Physical examination has been employed for a number of years without any marked objection on the part of the men. Examination of the men at the time the system was put in force proved beneficial. One man working on an elevated platform was found to be suffering with high blood pressure and fearing that he might become dizzy and fall from the elevation, the docter suggested that he be given work on the ground floor This was promptly arranged to the satisfaction of the employe. It is immaterial whether there is any apparent economy in safety work of this kind. An efficient working force with small loss of time; or the saving of life and limb, is worth while. and they all tend towards increased production.

Laborious Work Eliminated

The present industrial unrest, its causes and what may be done to reduce it to a minimum has been receiving the company's attention for a long period. It was found, in manufacturing an improved design of product, that the weights of the parts were considerably increased. This made the work unusually heavy and laborious. The condition, it was felt, might eventually affect the physical ability of the men, if they were to continue working under the old methods. This had been recognized for some time and a careful study was given the subject. It was decided that the men should be relieved from heavy work wherever possible Any improvement in this direction was considered desirable, and at the same time could be fairly considered under the head of safety when it assisted in reducing the amount of physical effort required. The first device to meet the new requirements was tried some time ago and resulted in aleviating the working conditions materially and at the same time eliminated the neccessity of the men being exposed to great heat from the hot castings, which was particularly fatiguing during the summer.

At another locality in the shop the men were constantly engaged in assembling the heavy parts. The work is laborious and the production necessarily limited; depending largely upon the physical condition of the men and the seasons of the year. It was recognized that although the men were skilled in this particular line of work, they were handicapped in producing a large output on account of the weight of the parts. Appreciating the necessity of obviating this heavy work and at the same time maintain production the company installed a mechanical device by the use of which the workmen will eventually be relieved of practically all handling of heavy pieces. The material is now conveyed to them by this experimental machine. The men recognize the advantages it gives them in reducing their efforts, and at the same time the production per man is increased.

The National Transit Pump & Machine Co., Oil City, Pa., manufacturer of pumping machinery and supplies recently has inaugurated classes in shop practice for its employes. Paul V. Kline, metallurgist is in charge.

Use Metal Lighter Than Aluminum for Alloys

The lightest metal now known that remains comparatively unaltered under ordinary atmospheric conditions is magnesium, which is only two-thirds as heavy as aluminum. Magnesium is a beautiful silvery-white metal that has been made in the United States only since 1915 and is now made at but three plants. It is known to comparatively few people and to most of those few chiefly as a silvery powder used for making flash lights in photography. It was imported from Germany for this use for many years. During the world war large quantities of powdered magnesium were made in the United States for use in star shells designed to illuminate battle fields at night, as well as in special shells designed to show in the daytime exactly where the shells containing it exploded.

Magnesium in massive form, as sticks or rods, is used to deoxidize other metals in foundries and is a constituent of alloys. More magnesium is now used as a deoxidizer or scavenger in metallurgy than for any other purpose, but its employment in alloys is increasing and may eventually become the largest one. An alloy of magnesium and aluminum is used in making castings for aircraft engines and parts of airplanes. The skeleton of the British airship R-34, the first dirigible to cross the Atlantic, is an alloy of aluminum and magnesium, and the yacht RESOLUTE, the defender of the AMERICA'S cup in the races in July, 1920, carried gaffs of this alloy.

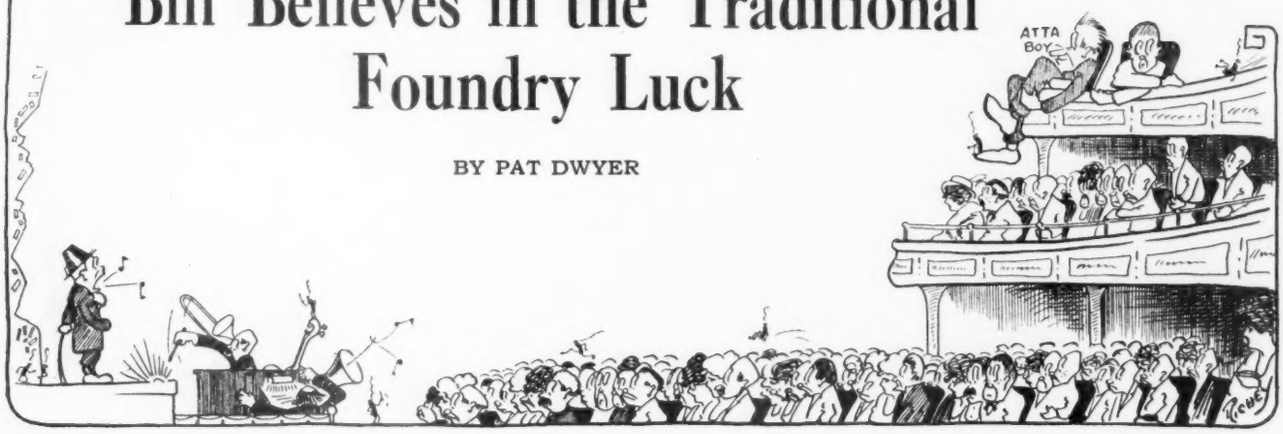
The demand for metallic magnesium has slackened since the war, however, and in 1919 its production in the United States amounted to 127,465 pounds, valued at $247,302, a decrease of 55 per cent in quantity and 60 per cent in value from 1918. A report on the magnesium industry in 1919, by R. W. Stone, can be obtained free on application to the director, U. S. geological survey, Washington, D. C.

Takes Over Engine Plant

The E. W. Bliss Co., Brooklyn, builder of motor driven presses, which recently took over the plant of the Buckeye Engine Co., Salem, O., is arranging to operate this plant along the line of the policy pursued at its other plants. Readjustments of the working conditions at the plant will mean the temporary laying off of men in the various departments until the work is rearranged. The plant will be operated in connection with the Cleveland works of the same company devoted to the manufacture of motor driven presses and repair work.

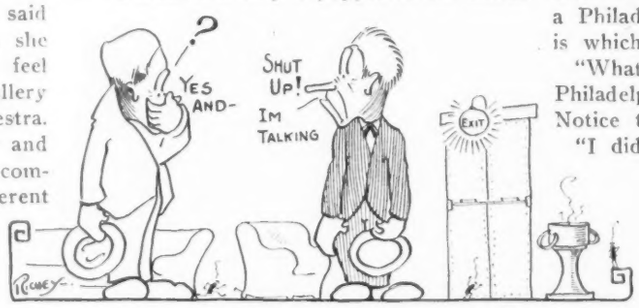
Bill Believes in the Traditional Foundry Luck

BY PAT DWYER



ONE night recently I had just settled down for a quiet draft of the weed when Bill called around and asked me to accompany him to the opera house to hear our old friend Chauncey Olcott sing some of his tuneful Irish ditties. I approached the treasurer diplomatically and endeavored to negotiate a trifling loan of two dollars. She laughed at my presumption and said that she would not mind buying a $2 ticket if she was to accompany me; but since I was going with Bill she thought a 50 cent seat in the gallery would be good enough for me. She even went further and said that knowing me as well as she did she thought I would feel more at home in the top gallery than I would in the orchestra. She is a most estimable lady and we have many interests in common; but we are of different nationalities and our views do not coincide on the subject of music. She is a direct descendant of the race of dauntless ancestors who went out in the '45 and swung Scotland's broad claymore in the wake of Bonny Prince Charlie. Gallant gentlemen who fought and bled in defense of a principle and whose bones were picked clean by the crows and the corbies and left to bleach white on the lonely moors after Culloden. I have no fault to find with the lively interest and allegiance which she cherishes for the traditions of her race; but really, I cannot endorse her partiality for the bag pipes.

I accepted the four bits with the mental reservation that when St. Andrew's night arrived I would buy her a gallery ticket for the concert staged on that occasion by the local members of the honored Order of Scottish Clans. Bill and I went down to the theater and our enjoyment of the show was only equalled by our wonder that the veteran Chauncey did not look a day older than he did the first time we saw him in the Hyperion theater in New Haven one night in 1900 and heard him sing "My Wild Irish Rose" in "A Romance of Athlone." On the way home Bill was moved to remark that it was a curious thing the way events shaped themselves in a man's life; the places he goes to and the people he meets and the work he does. He expressed the opinion that a man was only a puppet in the hands of fate and his progress through life a matter of luck and chance.



BILL CONFESSES HE'S A PUPPET, BUT REJECTS AFFIRMATION MODESTLY INTIMATING A DESIRE TO SAY A WORD

"This is particularly true in the foundry business," said he. "You may call it what you will, luck, chance, fate, accident or the finger of providence, the fact remains that castings frequently are lost through wholly unpreventable causes. Hoists break down, chains slip, chaplets work loose, copes drop, unsuspected weak spots develop in the equipment or rigging and eventually give way, water seeps into the bottom of a pit in which many castings formerly have been made successfully. In fact there are so many factors entering into the production of castings, especially large work, that no man positively can say that a given mold will produce a good casting until the casting has been poured, shaken out, chipped and cleaned. Even then it may develop flaws in the machine shop or when it is tested under steam or water pressure.

"However, many bad castings are charged to foundry bad luck which really are the result of errors of judgment either on the part of the man who made them or on the part of the foreman. The peculiar feature of some of these things is that the margin between luck and error of judgment is so narrow that it would take a Philadelphia lawyer to decide which is which."

"What's the idea of dragging in a Philadelphia lawyer?" I demurred. Notice that demurred? Hot dog!

"I didn't drag him in," evaded Bill.

Evaded is rather neat, too, in its way. The discriminating reader will observe the knowledge of short story writing technique displayed in the foregoing sentences, and appreciate the fact that we are keeping abreast of these late times.

Strictly among ourselves I don't mind admitting that I am old fashioned enough to cordially detest that form of composition. It irritates me in the same manner that dragging a perpendicular pencil across a slate did in the good old days before scratch pads were invented. The perpendicular pencil tortured my ears and set my teeth on edge and these combination perpendicular verbs torture my sense of the fitness of things and put my mind on edge. With your kind permission we will stick to the word "said."

"'Twould take a Philadelphia lawyer to tell you anything," said he. "You persist in interrupting so frequently

and generally introduce such irrevelant remarks that no one, not a native of the city of brotherly love, would attempt to continue. If you would keep quiet once in an age, while people are talking you might learn something.

"As I was going to say a few minutes ago I'll tell you about a streak of bad luck which an old foreman of mine experienced some years ago. I worked for him afterward when he was successfully managing one of the largest and finest shops in this country, so don't start off with the assumption that he was not a competent man. He may have lacked experience or judgment in the first instance; but circumstances also conspired against him. We were discussing these things on the occasion of our second meeting and he laughingly admitted that he had learned a whole lot in the interim. He had come out from Scotland while a young man to assume the foremanship of a general jobbing shop employing 10 or 12 molders. One of his first jobs was a low-pressure cylinder for a local steamer. The casting weighed about 4 tons. Instead of leaving it in the hands of his leading man who was perfectly competent to make it, he made the job himself in dry sand and he certainly finished the mold in a highly workmanlike and creditable manner, and quite up to the standard maintained along Clydebank.

"The runners were set close to one side and the runner box, provided with a shelf, overhung the side of the flask. An old fashioned hand operated jib crane was employed to hoist the ladle and when the job was about half poured, the cable, which had been piling up on the drum, jumped, and the lip of the ladle came down on the edge of the runner box and upset it.

"Of course blue fire and profanity filled the air for several minutes. An attempt was made to pour the remainder of the metal straight down the runner but it was choked with loose sand and as a result the casting was a waster. If you cared to do so you could claim with a considerable degree of plausibility that he should have attended to that rope and prevented it from jumping. If you follow out that line of reasoning it will lead you to a point where you will decide that he should not have touched the job personally; but have contented himself with overseeing the work and the rigging. It is manifestly impossible for a man to be in two places at one and the same time and it also is manifestly a difficult job to watch two things at the same time especially when one thing is in front and the other directly behind as in the case of the runner box and the crane drum.

"Shortly after this incident the secretary of the company who sometimes did some traveling for the firm came back from a trip with a wonderful tale of the remarkable coke to iron melting ratio practiced by a competitor. He had not actually seen it done, you know, some one had told him it was done and with that peculiar gift which seems to be a common inheritance of young executives of believing that the other firm enjoys all kinds of advantages he came back determined to stop one leak at any rate.

THE SECRETARY STIRS THINGS UP A LITTLE

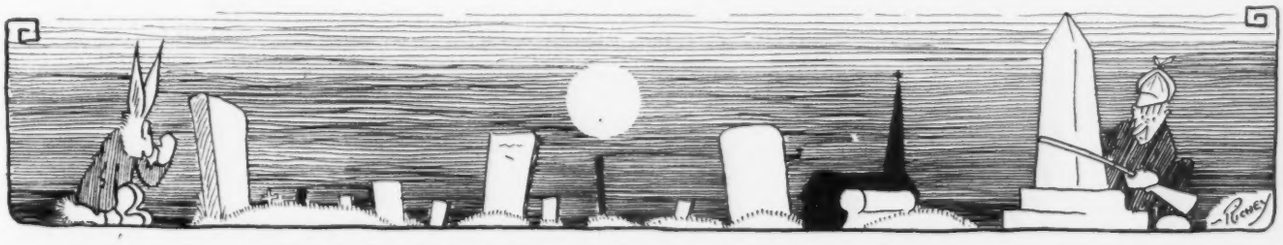
"He called the furnace man and the foreman into his office on the morning following his return and gave them to understand that he was quite disappointed to think that they had the welfare of the company so little at heart that they had been wilfully wasting at least a ton of coke a day. He ordered them to cut down the coke bed by 300 pounds and to take 50 pounds off each charge. His competitor was not going to put anything over on him, no sir, not if he knew it. The furnaceman protested; but was told that he was away behind the times and that really he should try and familiarize himself with modern methods.

The furnaceman followed instructions literally and the first heat was a beautiful mess. The iron came down about three minutes after the wind went on and he stopped her up as usual. When he attempted to tap the furnace a few minutes afterward the iron was frozen in the tap hole and he had to drive a steel bar through the breast with a sledge hammer. The bar stuck and when they did at last get it loose the iron that followed was too dead to use. They drained the cupola and dropped the bottom and then they had a nice job the next day breaking up the mess. The cupola man quit in disgust and the foreman had his own troubles trying to break in another man and trying to melt iron with a minimum coke consumption. The amount of coke gradually was increased from day to day and they were back to the original ration before they got satisfactory iron.

"Of course you will say that he should have put his foot down in the first place and refused to try such a foolish experiment. However, you must remember it was his first job as a foreman. He was in a strange country among strange people and was not familiar with the coke, the style of furnace or the current melting practice. He had no means of knowing that the line of talk accepted as gospel and brought home by the secretary was simply an exemplification on the part of the competitor of that grand old game known in these modern days by the technical title of 'Shooting the bull.'

"The final straw was added to the load when he attempted to make a grooved drum in loam. It is a perfectly proper way to make the job and in a shop where the facilities are available and the men accustomed to the work, produces an excellent casting. He had learned his trade in shops where loam and dry sand molds are employed much more extensively than they are on this side and did not care to risk the job in green sand. Again he made the mold personally and so far as the molding went it was perfect; but he slipped up in the drying.

"The job was too big to go in the oven so he had to dry it on the floor.



WHEN A RABBIT LOSES HIS LEFT HIND FOOT IT IS CONSIDERED UNLUCKY—FOR THE RABBIT

He should have made half a dozen coke baskets for this purpose but the firm, collectively and one at a time had commented so pointedly on the terrible expense involved in making a foundation plate and a lifting ring that he decided to try and do without the baskets and dry the mold with a wood fire.

"If I live to be as old as Methusaleh I'll never forget the agony I suffered on account of that wood smoke while the mold was drying. There may be nothing in it; but I sometimes have wondered since if the curses and maledictions frevently called down upon the foreman's head by every member of the shop crew without exception, were not indirectly responsible for the casting being a waster.

"Be that as it may, when the casting was lifted out of the mold, the grooves were so scabby that it had to be broken up. The foreman and the manager staged a spirited and snappy one act sketch over the remains. The foreman in the broadest Scotch dialect embellished by the most lurid and picturesque foundry profanity declared that he would not work in such a place another day if they made him a member of the firm. The manager in the same breath informed him emphatically, if less profanely, that he would not keep him another minute if it meant that he had to shut down the plant.

"They parted company without any further formality and as I said before the next time I ran across this foreman he was manager of what is conceded to be one of the finest shops of its kind in the world."

"All of which goes to show," said Bill, "that the ambitious young man who aspires to a foundry foreman's job has to be a molder, a coremaker and melter. He has to be a deep student of human nature and at all times wear a suit of chain mail next to his undershirt to repel the attacks of the wandering bands of Toreadors who always have and always will infest this fair land of ours. Furthermore if he wishes to avoid insomnia, indigestion, a padded cell; or an early grave he will provide himself immediately after his appointment and before his troubles commence with the left hind foot of a graveyard rabbit."

Scientific Melting in the Cupola Urged

BY A. C. PORTER

THE problem of scientific melting in the cupola should be of vital interest to all foundrymen. It tends to conservation of coke which is the only solution to the problem of foundry coke supply. What is the use of high production efficiency in all other departments of the foundry if the melting practice is not developed upon the same plane? The data, collected and published by THE FOUNDRY in the September 1 issue, shows clearly the inconsistency of foundries in their cupola melting practice and implies that this melting medium, used universally in all gray iron foundries is not receiving the attention it should. Do foundrymen not realize that it is the heart of the foundry?

The writer feels that the existing condition as shown by the article, referred to, is due partly to old fashioned methods; but to a greater extent to the inattention and apparent negligence of the foundry executives, through lack of knowledge of conditions in the cupola. This apparent neglect is due to fear that if any investigation or checking is attempted the melter will resent the interference and quit. Frankly, if more melters would quit and foundry executives used more common sense with regard to their cupola operation, the conditions as they exist today, would be greatly improved. A satisfactory method of arriving at the proper melting condition follows.

All manufacturers of cupolas and blowers publish tables giving the capacities of their respective products. These tables are derived from figures based on scientific theories. From the tables given a starting point is taken for our reasoning. For instance a No. 6 cupola of one design is rated at a melting speed of 10 tons per hour. To melt this amount of metal per hour a certain number of cubic feet of air must be burned with a certain number of pounds of coke.

By multiplying a given displacement in cubic feet per revolution of blower by the given number of revolutions per minute the cubic feet of air delivered per minute is found. In a similar manner the cubic feet of air delivered per hour is found. Allowance must be made at this point for loss, due to friction in blast pipe, which will vary with the length of blast pipe. The installation of a blast meter eliminates any chance of error in the calculation. The maximum temperature in cupola practice is attained by the formation and combustion of CO_2 gas, that is carbon dioxide gas, which requires one part of carbon, and two parts of oxygen. This combination generates 68,040 calories at the melting zone. The oxygen is taken from the air delivered by the blower, the carbon is taken from the coke. This chemical reaction requires 150 cubic feet of air as delivered through the tuyeres and one pound of carbon.

Knowing the number of cubic feet of air delivered per hour, dividing by 150 gives the number of pounds of carbon required per hour to unite with the air, to form CO_2. Scientific melting requires that all coke used shall be analyzed by car load, and different grades kept separately, according to the carbon content. From the carbon necessary for combustion and the carbon content of the coke used, it is simple arithmetic to find the number of pounds of coke needed per hour to furnish the desired amount of carbon. It is a conceded fact that each and every foundry has different shop conditions which require different melting conditions, some necessitating super-heated iron, and some pouring at much lower temperatures. These different problems are solved by using judgment in the size of metal charges. Unless the blower speed is changed the coke charges should remain constant. Owing to the different conditions in every foundry, no attempt will be made to provide rules for determining the size of metal charges, every foundryman understands these conditions in his respective shop, and is governed accordingly.

Taking the pound per hour capacity as rated, and dividing by the weight of each charge in pounds, the number of charges that should be put into the cupola is found. Dividing the pounds of coke required per hour by the number of metal charges, gives the weight in pounds of coke charges. This method of figuring will give a definite time to melt a charge of metal. There is no other way of knowing when a special mixture is ready to be tapped than by operating the cupola with a clock. Inasmuch as every tap is to be made in a given number of minutes, a constant check can be kept upon the melting conditions all through the heat.

It is well to emphasize that any attempt to figure in this way would be simply wasted effort unless careful supervision is given to charging.

Car Wheel Patterns Must Be Rugged

An Inset Brass Strip Around the Rim of the Flange and Six Steel Wearing-Plates Where the Flange Comes Into Contact With the Chiller Are Prominent Features

BY ARTHUR LANDERER

CAR wheel patterns designed for use in a regular car wheel foundry where they are subjected to rough and constant usage over an extended period, require to be of more solid and substantial construction than patterns which are only to be used a few times. Following is a description of the practice pursued in one leading railroad shop. Upon receipt of a drawing a layout board is made sufficiently wide and long to show full size plan and sectional views of the wheel. The top surface and bottom edge are hand planed to produce a straight side and smooth face on which to use the marking gage and square. The wheel is laid out by ⅛-inch shrink rule; after which the glue courses are laid out beginning with the center. The pattern is made of white pine with the exception of the last course in the rim. Screws are used as much as possible as they help to speed up the process of gluing the courses. After the wheel is glued, it is allowed to stand for at least 15 hours. During that time the templets for the inside and outside of the wheel are made, as also are those for the inside and outside of the ribs and the templets for the web core box, which is split in the center horizontally. The templets are made from ¼-inch stock and are accurately finished.

After the templets are made they are tried on the layout board and tested for accuracy. In case several similar patterns are to be provided, the templets are made of sheet tin with a wood backing. They are blue chalked and laid aside until needed. A wooden face plate then is selected large enough to take in the outside of the ribs and of sufficient thickness to allow for turning. The outside and inside diameter of the ribs are then laid out on the face plate after which a templet is made to go around this space about 12 times. Sufficient stock is prepared to fill this space and the whole ring glued together. The whole ring is enough for three wheels but after laying out enough for one wheel the remainder may be laid aside for future use. The ring for ribs is allowed to set for about 12 hours. The stock for the corebox is glued up next; followed by that for the chiller. The latter can be finished at once by using screws and nails and allowing for finish on the top, the bottom and the inside. The trunnion corebox and handles on the chiller are then made. Some foundries specify core prints on the patterns and some do not. An iron face plate is attached to the back of the wheel and the inside face turned. A templet touching

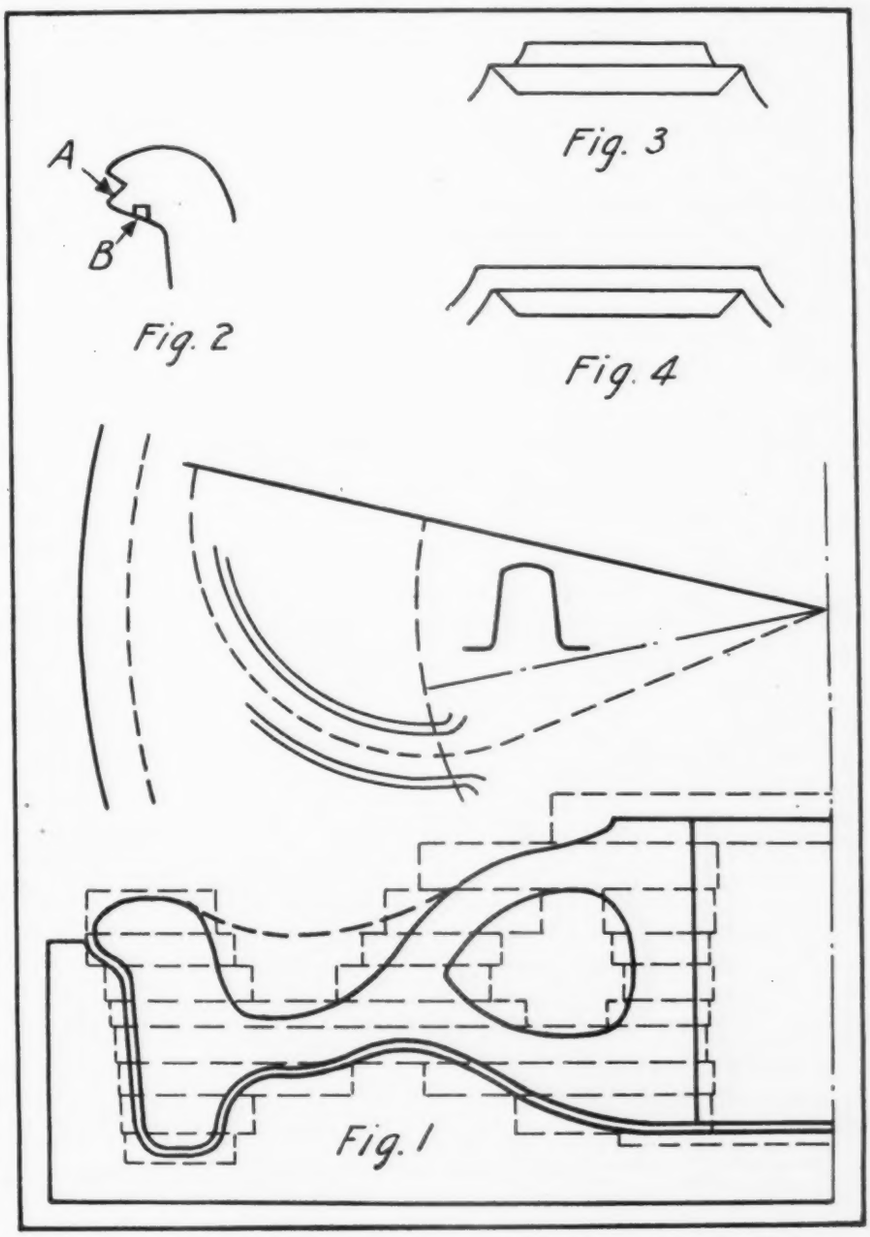


FIG. 1—SECTION OF STANDARD CAR WHEEL SHOWING METHOD OF BUILDING UP SEGMENTS FOR PATTERN; ALSO STYLE OF TEMPLET USED ACROSS THE FACE. FIG. 2—A BRASS BEAD IS INSET IN THIS GROOVE AND SIX STEEL PLATES ARE INSET AT EQUIDISTANT POINTS ON THE FLANGE TO WITHSTAND WEAR. FIGS. 3 AND 4—METHODS OF ATTACHING SMALL AND LARGE HUBS

the hub and both flanges, as shown in Fig. 1, is employed to check the work. After the rim is turned down to approximately the correct size and shape, the chiller is tried on. The wheel must fit the chiller in such a way that it may be turned around freely but no more.

The wheel is then returned to the lathe and shellaced after which it is again tried in the chiller. If correct, it is rechucked on a wooden face plate provided with six screwed on wooden lugs. The back is then turned using a templet to insure accuracy. After it is all finished, a *V*-groove is cut in the flange as shown in Fig. 2 to allow for a brass bead, made in 12 sections, to be attached with brass screws. This brass bead is inset while the pattern is in the lathe and after it is secured, a light finishing cut is taken off all around to true it. Before taking the pattern off the face plate, both pattern and templets are checked by an inspector.

The outside line of ribs is then struck on the pattern after which the ribs are turned by first using the inside templet. The ring then is taken off and screwed on the back of the wheel when the outside of the ribs is turned. The pattern is taken off after striking the line for the curve of the ribs.

The ring is removed from the pattern and the ribs laid out after the wheel has been divided into the number of ribs required. The ribs are then sawed out, sanded and rounded over with a draw knife after which they are screwed to the pattern, small brads being used at first to hold them in place. They are shellaced and sand-papered and then filleted with either wax or leather fillets. Putty fillet is made by adding a dab of hot glue to a handfull of putty and working it in the hands until it does not stick. It is made into a long roll and worked into place at the bottom of the ribs with a round fillet tool of the proper size.

Sometimes changeable hubs are made for different sized bores. For small hubs the usual arrangement is shown in Fig. 3 and when a larger hub is required it is slipped over the top as in Fig. 4. Recesses are provided in the face of the pattern for the brass plates carrying the serial numbers and date which are changed every day when the pattern is in use. The letters for the manufacturers name and the name of the railroad are attached permanently.

The three tapered core prints for the lightening core are attached at equidistant points on the upper face of the wheel, corresponding with the three teats in the corebox. A bead is fastened to the pattern around each core print to strengthen the wheel at these points.

Six small steel plates about ½ x 1 inch are inset at equidistant points under the flange to prevent the pattern from wearing down owing to its constant contact with the chiller. These plates are filed and fitted while they are soft; then marked, taken out and tempered after which they are screwed in permanently. The last thing done to the pattern is to insert 4 small round teats at the four cardinal points. They are left protruding 3/16 inch and come flush with the face of the chiller and always maintain the pattern absolutely in the center.

A pattern for a street car wheel is made in the same manner with the exception that there is no cored section in the web or plate center to be taken care of. Aluminum beads are screwed around the holes through the web. These holes leave their own green sand cores. To eliminate the use of parting sand when molding these patterns, the openings are covered with pieces of sheet tin; a space being left for the tin under the curved ribs before the latter are screwed into place.

The flange is glued together in three or more courses and turned separately and finished. The lower part of the rim is treated in the same manner. A suitable shoulder is turned top and bottom on the main part of the pattern to accommodate these rings. This arrangement permits many different flanges and rims to be used with the one body and allows them to be changed readily.

Six ¾-inch pieces of aluminum are inserted in the flange, flush with the top, to receive machine screw heads and six plates with threaded holes are screwed into the rim of the wheel. The loose lower rim is just screwed on with six screws. The loose flange and rim are made entirely of cherry.

Speed Is Essential in Repair Jobs

BY M. E. DUGGAN

THE one piece disk forming a part of the driving clutch on the line shaft operating the reverse rolling mill broke, causing a shutdown of this department until the repair could be made. Making the pattern and producing the casting for this repair job was, in my opinion, a masterpiece of speed.

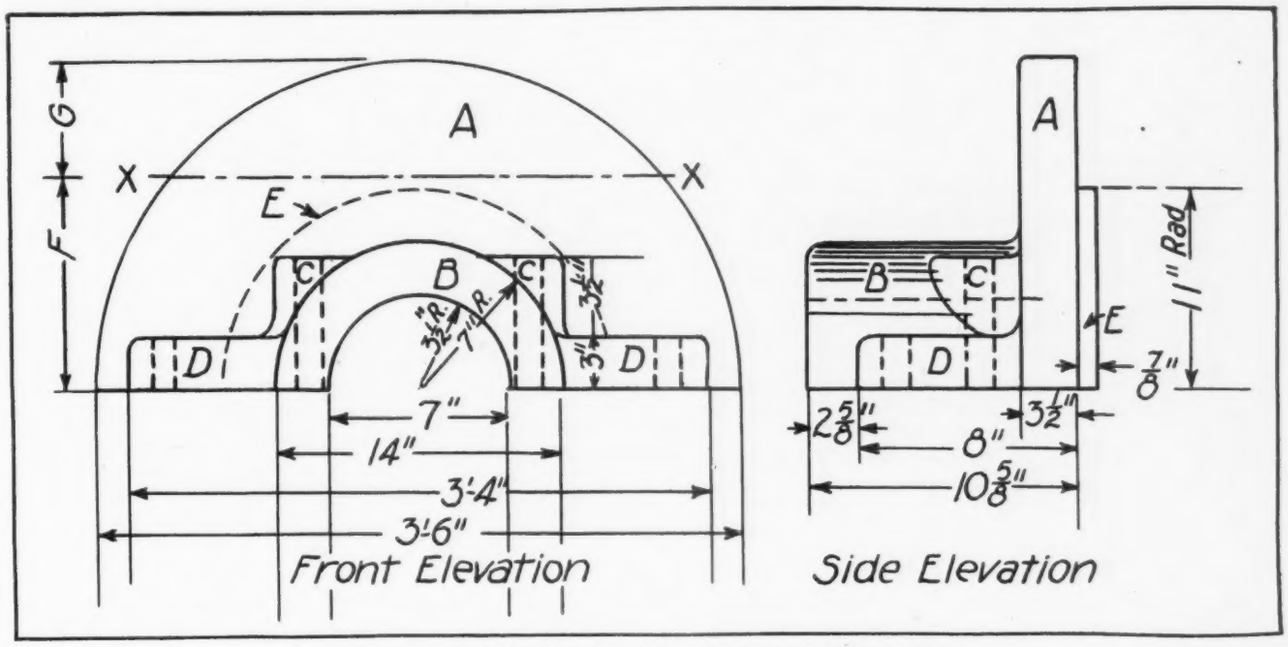
The original casting was in one piece, but it was necessary to make the repair job in two pieces, as shown in the accompanying illustration, in order to get it in place without disturbing any of the line shaft connections. The order for the pattern was received in the pattern shop at 10:40 a. m. While the pattern was being made a blueprint of the part was taken to a steel foundry some two miles away. The foundry foreman examined the drawing and then made the necessary preparations for ramming the molds immediately on receipt of the needed pattern.

The pattern was neither hand-tooled nor sand-papered. The half disk *A* was made of four pieces of 1⅞-inch double thickness pine lumber. No fastening of any kind was done on the joint *XX*. The two sections, *F* and *G*, were placed together on the bottom board; the ring, *E*, was loosely attached to the piece, *F*. Every part of the pattern was cut on the band saw, which was set to a taper of ⅛-inch to the foot. Cutting out the opening for the shaft was the last operation performed.

The pattern was received at the steel foundry at 1:45 p. m. and the drag for the first one was rolled over at 2 p. m. Both castings were made that day and were on the planer next day at 10 a. m. It may be of interest, to note that the castings weighed 1000 pounds each and that the pattern was the work of one man. A delay of two and a half hours was caused by sending the job to the drafting room in the first place.

This unnecessary drafting room delay is a mistake that is frequently made in a great many of the larger shops. Where the plant is small the foreman patternmaker or the foreman molder or both together are called to view the accident. Usually they can devise a way of making the job with a minimum of time and expense. In the larger plants where a force of draftsmen are employed, many of whom are not practical men, much time is lost on emergency work of this kind, by the draftsman insisting on an elaborate drawing.

In the other case when a breakdown occurs and a new pattern is required the draftsman is the first man to be called on the job. It makes no difference if the break occurs in the fore-



PATTERNS FOR ONE PIECE DISK FOR ROLLING MILL DRIVING CLUTCH

noon or at midday and a casting is wanted at once; he must first make a free-hand sketch of the broken part. If he would stop there and give this free-hand sketch to the patternmaker so that the latter could get started on the job there might be a possibility of getting the job within a few hours. Usually, he takes the sketch to the drafting room and makes a complete drawing, brown paper, tracing, and blueprint and wastes several hours of time.

Eventually he rushes into the pattern shop and tells the patternmaker that a casting must be made "today." Then the hustle and rush starts in the pattern shop. The pattern reaches the foundry at about the time the molders are pouring off and then the hustle and rush starts in the foundry. Sometimes it is too late and then the job must be held until the next day. Care in preparing emergency drawings is wasted.

Steel Foundries Need Standard Patterns

BY K. V. WHEELER

THANKS to the industrial engineer and to the mechanical ingenuity and commercial incentive of the manufacturers of foundry equipment, the majority of foundrymen are today enjoying the benefits of modern developments in machines, plant lay-out, method of handling and routing materials, and other improvements of a similar nature. It is indeed a pitiable sight to view a foundry that fails or refuses to recognize the fact that this is a progressive age, and endeavors to operate under conditions quite common a few years ago.

There is another problem, which though not so evident on the surface, is equally as essential to progress. New machines, tools, and methods of handling materials are visible assets because the foundryman can see them in operation and his records reveal their worth as compared with antiquated equipment and methods. However, this second problem which has been referred to is equally far-reaching and offers as great possibilities from a standpoint of results, as the installation of good equipment. The non-appreciation of this problem has been largely responsible for many failures, including not only those of foundrymen who have gone out of business, but also those of foundrymen who have not progressed. This problem is the impracticability from a commercial foundry standpoint of a large percentage of the patterns submitted to steel foundrymen for producing castings.

Standardization Needed

The foundry industry has no one but itself to blame for this condition, and there is little hope for relief until we have established definite standards to be followed in designing and constructing patterns for making steel castings. It is only by the establishment of such standards that engineers responsible for design and construction will recognize the existence of the fundamental requirements of patterns relative to the manufacture of steel castings.

A few foundries have taken the initial step in this direction by installing a systematic inspection of all patterns received and by calling to the attention of the customer patterns that are not suitable from a standpoint of intensive production and good castings. This suitability is not only for pattern construction, but for design as well, and when the customer knows that a foundry is conscientiously endeavoring to co-operate to the end of better castings and better production, he invariably concedes a well given point.

This education is slow work when done by only a few foundries and it will require the concerted action of all to gain the end we are striving for.

Although different foundrymen seem to think they have many conditions peculiar to themselves, we believe this is largely a matter of imagination and prejudice. The problem of pattern design and constructoin is not peculiar to any one shop; in a broader sense the principles applicable to one are applicable to all.

A few years ago a suggestion of this kind would have aroused a storm of indignation from the various foundrymen holding conflicting views as to the best methods of making a casting, and also as to what constitutes a desirable design. However, with the broader minded men of today, we believe it would be possible to have all steel foundries of the same

Paper read before the convention of the American Foundrymen's association, Columbus, O., Oct. 5, by K. V. Wheeler, Lebanon Steel Foundry, Lebanon, Pa.

class adopt certain standards in this respect, providing they can be shown these standards will be productive of the best results.

Let us take for example the amount of stock allowed for machining. Why should one foundry ask for ¼-inch finish allowance, another 3-16-inch allowance, while still another should be willing to make the same casting with only ⅛-inch or less finish? Why should it not be possible to esablish a standard of finish allowance for different classes of work and have all patterns of that class made to standard in this respect? This would help the customer in placing patterns from one shop into another, inasmuch as he could feel safe that they were correct in this respect and furthermore, foundrymen would not need to fight with every new customer to gain the required stock necessary to make a good commercial casting, merely because some impractical visionary had declared it to be possible to make steel castings without machine shop allowance for machine finish.

The question may be raised that, as different foundries have different methods of making similar castings, the allowance for finish would vary for different foundries. This might be true at the present time, but regardless of the job, there surely must be one best way to get a good commercial casting. Take into consideration molding cores, cleaning, yield, etc., and although these practices may vary in different shops, the one best way must necessarily appeal to all progressive foundrymen, and eventually, we hope there may be a standardized way of making all castings of any particular type.

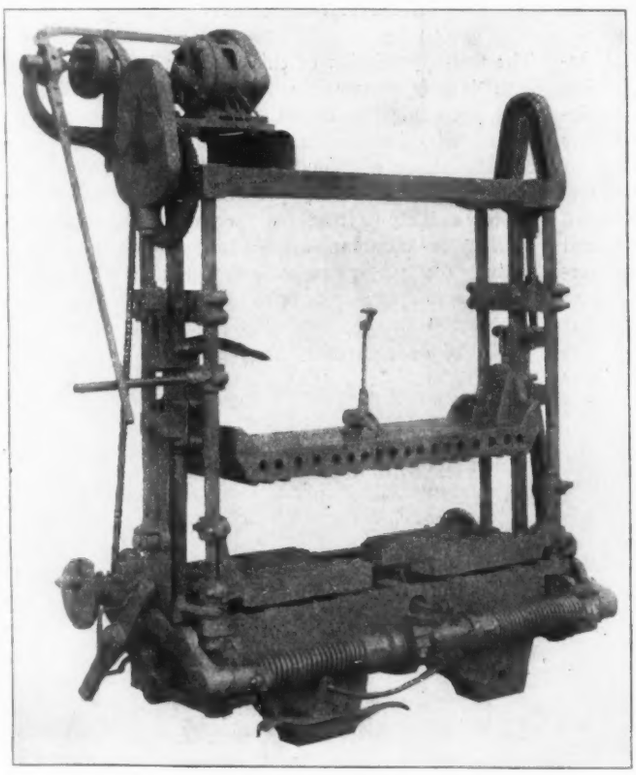
Again take the cross section of metal in relation to its length and breadth. Why can we not establish a standard in this respect? Possibly some foundries have established such a standard, but if so, it has not been the writer's good fortune to be acquainted with them. However, we do believe it a possibility to determine upon a maximum and minimum limit in this regard, and one which would be of practical value to all. Obviously, this would eliminate many so called mean undesirables before they would be placed in the foundry, and much unnecessary work and expense would be saved to customer and foundryman alike.

At present each foundry is apparently a law unto itself, and a man is one organization considered efficient and capable, may be at a great disadvantage should he for any reason transfer his connections to some other foundry. Moreover, the knowledge of foundry practice to be gained through a course of study in any of our schools is elementary in the extreme. In comparison with other lines of industry there is less to be gained from a technical study of the foundry than that of any other trade, and this is probably largely due to the fact that there are no established standards that can be placed at the disposal of the schools.

Devise Light Motor Operated Machine

THE molding machine shown in the accompanying illustration is an adaption of a type formerly manufactured by the American Foundry Equipment Co., New York; but now handled by the Whiting Corp., Harvey, Ill., a company with which the American Foundry Equipment Co. recently has become affiliated. The original machine was a combined jolt and squeeze machine designed to make cope and drag at one operation and required the services of one man. The weight of the cradle was counter balanced by a pair of torsion springs a feature which enabled one man to lift and jolt the mold by hand. The squeezing pressure was transmitted through a cam arrangement operated by means of a long lever.

The new machine which recently has been placed upon the market differs from the original type only in the fact that electric power is employed to perform the different operations. A 1-horsepower motor mounted near one end and on top of the frame of the machine furnishes the required energy for jolting and squeezing the molds. The action of the machine is controlled by two levers attached to suitable friction connections. The upper lever is controlled by hand and operates the mechanism for squeezing the molds; the lower lever is arranged to be worked by the operators foot and is used for throwing the jolting gear into action. The essential parts of the machine are a base and end frames a revolving cradle carried by vertically sliding cross-heads, a pair of weight carrying torsion springs, a clamping device, cradle lifting mechanism for jolting, rolling over, and drawing patterns, a squeezing mechanism and two swinging work tables. The base which has to withstand most of the strain is constructed of heavy gage gray iron castings. The end housings are of gray iron with machined vertical sideways for the cradle crossheads. The cradle carrying the work is machined accurately and can be revolved in the crossheads with ease even when loaded with heavy molds. It is ribbed and reinforced to withstand the severe strain of the squeezing operation and apparently there is no spring or reflex action. This feature assures perfect draws even of the deepest and most delicate natures.



THE CRADLE SHOWN SUSPENDED BETWEEN THE COLUMNS IS LOWERED UNTIL IT RESTS ON THE TABLES BEFORE ANY ATTEMPT IS MADE TO RAM THE MOLDS

The clamping device is an important adjunct for securing the squeeze and bottom plates to the cope and drag. After striking off, a steel bar with clamping feet at the ends is placed

to rest centrally on the squeeze and bottom plates and is held in place by a hook attached to the cradle. This hook is adjustable and may be used on any flasks within the capacity of the machine. The ends of the bar are turned eccentrically and upon giving the bar a partial rotation, the feet are firmly pressed down, making a dependable support for the work while rolling it over. During the squeezing operation the clamp bar is released automatically and drops away

The two horizontal torsion springs shown near the bottom of the base counterbalance the weight of the cradle and thereby minimize the effort necessary for lifting the mold to jolt it or to roll it over. Adjusting nuts are shown on the spring shaft by which the torsion springs may be adjusted to varying loads when patterns and flasks are changed. The weight lifted and dropped in jolting is substantially that of the flask and sand; the weight of the cradle and as much of the remaining load as may be desired is offset by the spring tension.

To make a mold on this machine the pattern boards are attached to the cradle by bolts provided for that purpose. The cope and drag parts of the flask are set, one on each pattern board. After they are filled with sand, the foot lever is depressed. This brings the friction mechanism at the back into contact, with the result that the cradle is jolted as long as the man's foot remains on the lever. The surplus sand is then scraped off and the bottom plate and squeezing plate adjusted to the drag and cope. After the clamp is fastened the upper mechanism is thrown into gear and the cradle raised until it is high enough to swing clear. The friction clutch is thrown out with one hand and the cradle locked with the other by means of a suitable lever provided for that purpose.

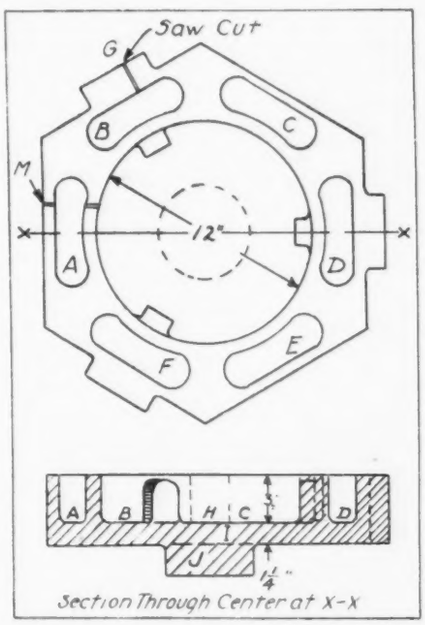
The cradle and flasks are then rolled over as a unit and the friction contact at the top of the machine again brought into play. The heart shaped internal gears shown at the top of the machine at both ends are attached to the sliding crossheads supporting the cradle. A small shaft terminating in a spur pinion at each end is driven by the large sprocket wheel shown in the vicinity of the motor and serves to impart a steady and positive action to the squeezing head. After the mold is squeezed the mechanism is again thrown into gear and the cradle is lifted, automatically drawing the patterns.

In many power squeezing machines the mold is pushed up against a stationary head. In this machine the mold is pushed down against the base and on the return stroke the squeezer head acts as a pattern drawing device. The finished molds are left supported on a pair of pivoted tables which by a simple fork and cam arrangement on the side can be lifted enough to clear the base. They are then swung around to the front from where they can be lifted and set on their appointed place on the floor.

Chucking Head Patterns

By M. E. Duggan

A short time ago I heard a foreman patternmaker lecturing one of his men for having made a pattern as shown in the accompanying illustration. Because there was only one casting wanted the patternmaker decided that a cheaply constructed pattern would answer the purpose. Therefore he made a flat plate for the top *I* and cut the part *H* out of a solid block of wood. The block was dressed to the required thickness and the design shown in the accompanying figure was marked on it. It was then taken to the band saw and the openings *A*, *B*, *C*, *D*, *E*, *F* and the hole in the center were cut out. The table of the band saw was slightly tilted to give draft to the openings. In order to get the saw into the interior of the spaces, saw cuts were made from the outside as shown at *M* and *G*. Each of these cuts was afterward filled in with a plug. The piece *H* was then glued and nailed to the plate *I*, after which the plate was sawed and finished on the outside. The hub *J*, on the cope face of the pattern, was made loose. No hand tooling was necessary, the band saw and a sheet of sandpaper were the only tools use on the job.



PATTERN FOR A CHUCKING HEAD

Instead of being pleased at the initiative shown, the foreman stated that a practical patternmaker would not be guilty of making a pattern that way. For his part he preferred to cut the openings out of the solid or else to make a solid pattern with core prints.

Oil Field Supply Firm Increases Stock

In their annual meeting, recently held, stockholders of the Mack Mfg. Co., Ltd., Houston, Tex., voted to increase the capital stock from $500,000 to $2,000,000. The increase is to be used to erect additions and install more equipment in the company's modern reinforced concrete plant, which comprises a large gray iron and steel foundry, as well as a forge and machine shop, for the manufacture of oil field supplies. A branch plant is to be erected either in northern Texas, probably Dallas, or in Oklahoma, for the manufacture of cable tool equipment. J. O. Mack is president and general manager; H. L. Sadler is secretary; and Charles R. Edwards is plant superintendent.

Organize Sand Company

The Silica Granite Products Co., has been organized with headquarters at Hamilton, Ontario, Canada. A. R. C. Smith has been elected president and A. Caddie is secretary-treasurer.

A formation of granite rock on the company's property of 160 acres will be quarried and crushed to various sizes as a base for cleansers of different kinds, such as dry and wet hand cleansers, household cleaners, etc. A medium size will be disposed of for the purpose of cleaning castings by sandblasting. Installation of machinery is practically completed and the company expects to begin to ship about Dec. 1, 1920.

Open Pittsburgh Office

As sales agent for a line of mine and mill equipment, planers, power and drill presses, lumber, wood and metal patterns, etc., the Wholesale Equipment & Supply Co., has established headquarters at 1002 Farmers' Bank building, Pittsburgh. D. R. Sterrett is president and he has associated with him, S. F. McLeod, who for many years was purchasing agent for the Duluth, Missabe & Northern railroad. Mr. Sterrett formerly was purchasing agent of James H. Matthews & Co., Pittsburgh. Branch offices in Birmingham, Ala., and in Chicago are contemplated.

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Separate Facts From Tradition

SOMETIMES such moves are made in the foundry that one wonders whether foundrymen are governed by actual knowledge or by tradition. As an example of this the case of the practice in molding and casting a large brass sphere might be cited. This originally was molded with the gates and risers several feet higher than the casting to give strong head pressure on the metal when in the mold, and when ready to pour all doors and windows in the small foundry were closed. A little later this pattern was transferred to another foundry and the first move made by the new operators was to decrease the height of the gates and risers to the height of the normal thickness of sand above the casting. However, notwithstanding dire predictions from the former makers, the castings were good, although made with short gates and risers and without paying attention to minor draughts which might blow across the foundry through open doors or windows. A high percentage of them withstood the severe water test to which they were put. Now the question presents itself: Did the high risers assist in producing a better casting? The last mentioned foundry did not report a thorough investigation but said that they made a casting which would withstand the test required of it. On the other hand, the first makers for years had gone to the expense of extra risers with the more costly molding operation and did not prove that the process was any better for this particular casting than the one adopted by the other firm. Had this original process of molding been adopted through tradition without a scientific basis it might have paid to investigate more thoroughly before adopting it. However, the average foundry cannot afford to do much investigational work on the average job. It is cut and try until a satisfactory method is found. Of course, the foundryman follows rules in which he believes when trying different methods of gating his pattern, but unfortunately these rules often are based more on tradition than on a scientific knowledge of the physical characteristics of the metal. When trouble shows itself in the foundry, remedies are tried by the foreman and if they prove successful little is said about the methods used to get out of the difficulty, but if the troubles increase, the superintendent usually takes a hand and suggests three or four remedies which all are put into operation simultaneously. If the castings then are made successfully, satisfaction governs and the change which was most prominent in the mind of the superintendent usually is given the credit for overcoming the trouble, whereas one of the minor changes may have been the crucial one. If the trouble was serious enough and the change a well defined one it would stand a good chance of going down in that foundry as tradition until a scientific knowledge of metallurgy and foundry practice proves or disproves it. With all the money spent on foundry operations, undoubtedly it would pay to decide more on scientific knowledge and less on traditional report. However, the foundry superintendent cannot be expected, when in trouble, to try one remedy at a time in order to discover which produces the desired results—he must act quickly. Probably the only way in which the scientific study could be co-ordinated with the practical trial in solving foundry problems would be to have a foundry equipped and operated with direct profits only incidental to experimental works.

Trade Outlook in the Foundry Industry

NO ONE will attempt to deny that the foundry industry in general is severely affected by the depression which has swept the country. Practically no one of the many main divisions nor subclassifications of the castings manufacturing business has escaped. Yet the prevailing tone of sentiment among foundrymen is far from pessimistic. Although they have seen inquiries cease and existing orders shrink through cancellations, "hold-ups" and the devouring advance of daily operation, they look for better times "after the first of the year."

Effect Cumulative

With this sentiment prevailing, many are going about setting their plants in order for the expected return of average business conditions. Although raw materials are not being contracted, the market is watched closely, and many, particularly those having contracts entered upon before the heaviest advance in the prices of fuel and metals, are stocking as liberally as their financial abilities will permit. Hope for relief through liberal buying of railway equipment is given by some to support their belief in an early return of activity. It is pointed out that although there has been no general movement in this direction, isolated instances of small lot buying of locomotives, cars and other equipment support the belief that railroads will enter the market soon after the first of the year, when prices will have reached a more stable basis. Counter to this hope, is the realization that railway profits have been seriously affected by the slump in freight movements incident to the general depression. This condition has operated in a measure to remove the pressing need for new rolling stock and motive power in addition to curtailing the buying power of the lines.

Prices of Raw Materials for Foundry Use

CORRECTED TO NOV. 26

Iron		Scrap	
No. 2 foundry, valley	$42.00 to 45.00	Heavy melting steel, Valley	$21.00 to 22.00
No. 2 Southern, Birmingham	36.00 to 38.50	Heavy melting steel, Pittsburgh	22.00 to 23.00
No. 2 Foundry, Chicago	40.00 to 46.00	Heavy melting steel, Chicago	17.00 to 17.50
No. 2 Foundry, Philadelphia	41.80 to 44.50	Stove plate, Chicago	25.00 to 25.50
Basic, Valley	35.00	No. 1 cast, Chicago	22.50 to 23.00
Malleable, Chicago	41.50 to 42.50	No. 1 cast, Philadelphia	32.00 to 33.00
Malleable, Buffalo	44.25 to 46.25	No. 1 cast, Birmingham	30.00 to 32.00
Coke		Car wheels, iron, Pittsburgh	36.00 to 37.00
Connellsville foundry coke	$ 9.00 to 10.00	Car wheels, iron, Chicago	28.50 to 29.00
Wise county foundry coke	12.00 to 12.50	Railroad malleable, Chicago	18.50 to 19.00
		Agricultural malleable, Chicago	18.50 to 19.00

Cause and Effect

The deterring factor which serves to augment the stagnation is the reluctance of consumers in all lines to buy, partly through a desire to obtain lower prices and partly through curtailed buying power. Wage earners are facing part time employment and reduced wages, and have cut their expenditures to bare necessities. Farmers, even with the sustaining influence of tremendous crops have seen prices for their commodities drop steadily until many face an actual loss in operating their farms this year. As a result all of those industries which supply the foundries of the country with work have felt the pinch. Starting with automobiles, the reaction has followed quickly in other lines until now even those staple products of the foundry such as stoves, plumbing goods and cast iron pipe are practically unsought. Within the past two weeks, the larger manufacturers of the latter product have come almost to the end of their existing orders and in the absence of future bookings, practically all of them will be shut down before Jan. 1. However, it is believed by many that with the easing up which is noticeable in the money market and growing demand for bonds, early spring will see a large volume of business which has been held in abeyance through the war period and succeeding months when industrial securities made municipal indentures practically unsalable.

Tool Interests Hopeful

Manufacturers both in New England and the Central States are hopeful, although the past month has seen little activity in machine tool lines. Many foundries which have been devoted to the production of castings for tool builders have been forced through absence of orders to turn to other lines, but recently expressed opinion urges a stocking of tools against anticipated demand in the forepart of next year. At a recent annual convention of the machine tool builders, the business was pronounced fundamentally sound. It was stated that the prices for machines had not advanced in proportion to other manufactured articles, and that price reductions further than those made recently were not demanded. The president of the association urged that a greater reserve of stock machines be kept on hand to cover improvements in the product and experimental work. Uncertainty as to future prices has brought about a complete deadlock in pig iron buying. Foundries which are confronted by cancellations, and those which although supplied with work for the present are receiving no orders for the future are not contracting iron for 1921 delivery. Further, some who anticipate a period of idleness have canceled iron which shipping conditions at this time would permit to be delivered without difficulty. Furnaces are reluctant to make any price concessions in the face of high operating, fuel and ore costs and rather than stock iron at the present high costs many are blowing out. The radical decline in coke proces which was noted some weeks ago has not continued, and prices are fairly stable. This is due partly to freight congestion in the coke regions and resultant poor deliveries. Some larger furnace interests are offering by-product coke which they do not need, at a range which corresponds favorably with the beehive fuel.

Nonferrous Inactive

Brass and aluminum foundries have not escaped the pinch. There is practically no demand for nonferrous castings used in automobile production while the demand for domestic commodities is slack. Prices for nonferrous metals, based on New York quotations of Nov. 26, follow: Casting copper, 13.87¼c; lead, 6.50c; Straits tin, 35.00c to 35.25c; antimony, 5.87½c; aluminum, No. 12 alloy, producers' price, 32.00c, and open market 25.00c. Zinc is 5.80c. East St. Louis.

Comings and Goings of Foundrymen

HARRY E. Kies recently has been made general superintendent of the Erie Malleable Iron Co., Erie, Pa. and assumed his position Dec. 1. This represents a return to familiar fields, for Mr. Kies was in charge of various departments of the Erie plant previous to 1911. Since that time he has served as foundry manager for the Michigan Malleable Iron Co., Detroit, and the Detroit plant of the Aluminum Castings Co. which now is the Aluminum Manufacturers, Inc. In 1912, Mr. Kies went to Germany to care for the interests of the American Radiator Co. at its malleable plant in Neuss-am-Rhein. Since 1915 he has been manager of the malleable department of the American Radiator Co. with direct charge of the malleable plant at Buffalo.

William T. Stewart has resigned from the Unique Brass Foundry Co., Inc., Buffalo, N. Y.

J. D. James has been made assistant to George F. Grivel, Buffalo representative of the Whiting Corp., Harvey, Ill.

Nils Anderson, president of the Debevoise-Anderson Co., 56 Liberty street, New York, has returned to this country after an eight weeks' trip in Europe.

G. J. Fichenlaug has been placed in charge of the branch sales offices established in the Medea building, Johnstown, Pa., by the International Fuel & Iron Co., Pittsburgh.

Robert E. Kinkead formerly engineer of the welding department for the Lincoln Electric Co., Cleveland, has joined the technical staff of the Mitchell Co., formerly A. F. Mitchell & Son Orleans St., Chicago.

S. C. Wilson, who until recently has been connected with the main office of the Whiting Corp., Harvey, Ill., has been made sales engineer and appointed to the Pittsburgh office of that company.

C. C. Kerlin, formerly manager of the Haynes Stellite Co., Kokomo, Ind., which recently has been absorbed by the Union Carbide Co.; has been

HARRY E. KIES

appointed manager of the Globe Stove & Range Co., Kokomo, Ind.

W. S. Quigley, president of the Quigley Furnace Specialties Co., New York, recently returned from Europe after an extensive trip in connection with large installations of the company's powdered coal system in Italy and Belgium.

C. P. Guion, formerly sales engineer, Chas. C. Kawin Co., Chicago, has become identified with the W. W. Sly Mfg. Co., Cleveland. Mr. Guion will be associated with Herman B. Kruelen as western representative of the Sly company with headquarters in Chicago.

Prescott V. Kelly formerly connected with the executive sales department of the Blaw-Knox Co., Pittsburgh, has been placed in charge of a new sales district established by the company in the South with headquarters at 408 American Trust Building, Birmingham, Ala.

Clifford F. Messinger who succeeds L. C. Wilson as general sales manager of the Chain Belt Co., Milwaukee, has been connected with that company in various capacities since 1909. He has been successively advertising manager, manager of concrete mixer sales and assistant to the vice president.

L. R. Fedler has been appointed district manager for the Keller Pneumatic Tool Co., in the Milwaukee district with offices at 915 Majestic Building, Milwaukee. Mr. Fedler has been associated for the past 12 years with the sales organization of the Chicago Pneumatic Tool Co., in the Milwaukee territory.

John C. Spence, superintendent of the grinding machine division of the Norton Co., Worcester, Mass., has been promoted as works manager, and is succeeded as superintendent by G. Ellsworth Brownell, who has been assistant superintendent. George N. Jeppson is general works manager as well as secretary of the company.

E. E. Allyne, president of the Aluminum Manufacturers Inc., Cleveland, formerly the Aluminum Castings Co., has resigned on account of ill health. He plans to spend the winter in the South. W. P. King, formerly vice president, has been elected to suc-

DETROIT FOUNDRYMEN GATHERED AT A BARBACUE ON GROSSE ISLE WHERE B

ceed Mr. Allyne. He will also be treasurer. George J. Stanley, vice president, who occupied the latter position, now becomes vice president in charge of production. John H. Watson Jr., was re-elected secretary.

L. C. Wilson, for the past two years general sales manager of the Chain Belt Co., Milwaukee, has been elected secretary of the Federal Malleable Co., West Allis, Wis., manufacturer of malleable castings, malleable chain and molding machines. He assumed his new duties on Nov. 15 and was succeeded as manager at the Chain Belt Co., by Clifford F. Messinger. Mr. Wilson is a Yale graduate and began his business career as a salesman with Harbinson-Walker Refractories Co., Pittsburgh. In 1917 he became associated with the Chain Belt Co. and until his appointment as sales manager acted in the capacity of assistant to the vice president.

L. K. Walker, superintendent of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., was the speaker at the regular monthly meeting held by the Philadelphia Foundrymen's association on Nov. 10 in its rooms at the Manufacturer's Club, that city. The program comprised a motion picture in three reels showing the manufacturing process involved in the production of wrought iron pipe and boiler tubes from the receipt of the ore at the blast furnaces and its fabrication into pig iron ingots, slabs, rolling, etc., until it comes out finished and ready to ship at the works of Reading Iron Co., Reading, Pa. A one reel comedy film and a luncheon at the grill concluded the program.

H. S. Mulliken, of Lexington, Mass., has been appointed metallurgical engineer of the Bureau of Mines, and has been assigned as an assistant to Dr. F. G. Cottrell, the director, in special professional work connected with the bureau. Mr. Mulliken is a graduate of the Worcester Polytechnic Institute, Worcester, Mass. He has been variously connected with mining and metallurgical enterprises as superintendent of the lead smelter at Pilot Bay, British Columbia; superintendent of the American Smelting and Refining Company smelters at Aguas Calientes and Monterey, Mexico; general superintendent and plant manager of the Penoles Companies at Mapimi, Mexico; for six years in charge of the metallurgical operations of the American Metal Co.'s interests in Mexico; and later was consulting engineer in metallurgy for the same company

Detroit Foundrymen Hold Old Time Barbecue

Detroit foundrymen had a big and enjoyable social event at a barbecue held Nov. 13, at Gray Gables, the home of H. M. Lane on Grosse Isle, Mich. This is a large island connected with the mainland by a bridge and situated about 18 miles from Detroit. The barbecue was planned by E. J. Woodison and H. M. Lane. Mr. Lane secured a bear, and after properly fattening him on pears, apples and other choice foods had him turned into bear meat at the same time that a couple of sheep were transformed into mutton.

Invitations were sent to all foundrymen in the neighborhood of Detroit, and the entire lower floor of the house was fitted up as a dining room, as was also a large garage and shop to the rear. About a hundred and fifty foundrymen signified their intention of attending. However, approximately one hundred more took a chance and came without notification, so about two hundred and fifty guests gathered for the feast.

National Safety Council Elects Officers

At the October meeting of the National Safety Council held in Chicago, Ira V. Kepner, the Pennsylvania Salt Co., Philadelphia, was unanimously elected fifth vice president. At the same meeting President C. P. Tolman announced the following committee appointments for the year: First vice-president W. H. Cameron to be chairman of the committee on service to members; third vice president W. E. North to be chairman of the finance committee; fourth vice president John A. Oartel to be chairman of the committee on local development and public safety; fifth vice president Ira V. Kepner to be chairman of the committee on publicity; David Van Shaack to be chairman of the committee on annual congress. Dr. L. A. Shoudy was appointed chairman and Miss Tracy Copp, Dr. Otto P. Geier, Dr. A. W. Colcord and David Van Shaack members of a committee to study and report on the health work of the council.

On Nov. 1 John J. Lamb assumed his new duties as safety engineer at the headquarters office of the National Safety council, Chicago, succeeding R. H. Guerrant who after two and a half years service left the council's staff to take up sales engineering work with the Industrial Appliance Co., Chicago. Mr. Lamb has been assigned to draft some of the "Safe Practice" pamphlets and sectional bulletins, a part of the council's work on safety codes and other engineering work.

Book Review

The Modern Electroplater, by Kenneth M. Coggeshall, cloth, 276 pages, 4 x 7 inches, published by the Norman W. Henley Publishing Co. and furnished by THE FOUNDRY for $3.

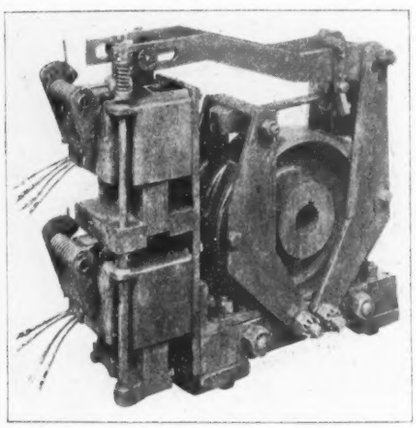
This is a complete practical book on the art of electroplating and allied processes prepared for the student and practical man. It is written in simple language and explains in detail the entire subject of electroplating. An elementary outline of electricity and chemistry as far as these factors relate to the subject is included, after which shop layout and equipment is taken up. Full information regarding efficient and profitable electroplating practice is given.

WHERE BEAR AND ROAST LAMB WAS SERVED BY H. M. LANE AND E. J. WOODISON

Full instructions are then included for preparing and finishing work while formulas are given for making all kinds of plating solutions. Of especial interest is the space devoted to describing the apparatus and materials used for finishing plated articles. Buffing and polishing are exhaustively treated while the various machines used are illustrated and described. The subject of dust collection is explained fully. The several varieties of setup wheels necessary for polishing plated materials are described and directions given for coating them with abrasives. The book is a valuable guide for those engaged in practical electroplating work.

Magnetic Brake for Crane Motors

The use of solenoid brakes for the speed control of induction motors on cranes and hoists has been greatly extended, due to their recent applications of this type brake in connection with other forms of electric braking. The two forms of brake as developed by the General Electric Company are the multiple magnet, and the solenoid load brake. The former is simply two solenoid brakes combined so as to form one brake actuated by two or more independent magnets. It is adaptable to traveling gantry cranes and to fast trolleys with swinging loads. Several methods of applying



BRAKE WITH TWO SOLENOIDS—USED ON CRANE MOTORS

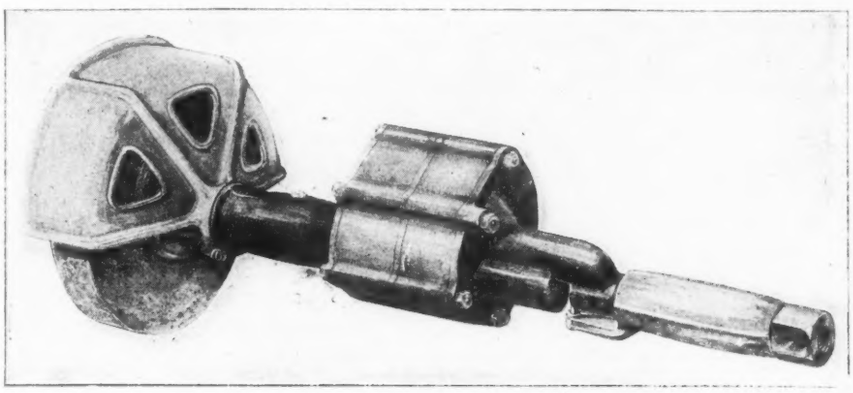
control to this system of braking have been standardized.

The other variety of brake, or the solenoid, load brake is designed for the control of induction crane hoist motors used where a number of varieties of loads are handled by the same hoist. This load brake consists of two solenoids, one in the stator circuit of the motor, and the other in the rotor circuit. The former is light enough so that little braking action is obtained from its operation. If the latter is de-energized, however, it applies heavier weight to the braking levers and consequently increases the braking effect.

An alternating-current crane equipped with automatic mechanical load brake, or dynamic braking.

Pneumatic Grinder

Pneumatic grinders are recognized by abrasive engineers as efficient units to use for foundry grinding operations where it is necessary to take the machine to the work. The Roto Pneumatic Co., Cleveland, recently developed a grinder of this type wherein the only moving parts are the pistons, slide valves and shaft. This device is shown in the accompanying illustration.



PORTABLE PNEUMATIC GRINDER FOR FOUNDRY USE

The motor housing as well as all bearings are bronze. The motor bearings are lubricated through the center of the shaft from an oil reservoir at the back of the case. The extended shaft bearings are lubricated from a reservoir in the handle. Lubrication of the cylinders and slide valves is accomplished by pumping automatically a limited amount of oil under pressure at every revolution of the shaft. Each oiling of the device is sufficient for five hours of continuous operation.

Air for operation enters through the control handle being applied to the pistons in the direction in which the shaft rotates. Due to the fact that the machine operates without crankshafts or connecting rods, it is pointed out the vibration is reduced to a minimum. The turn handle control is self sealing and is balanced so that the throttle stays in a given position until moved by the operator. Under normal conditions, approximately from 15 to 20 cubic feet of air under 80 pounds pressure to the square inch is consumed per minute.

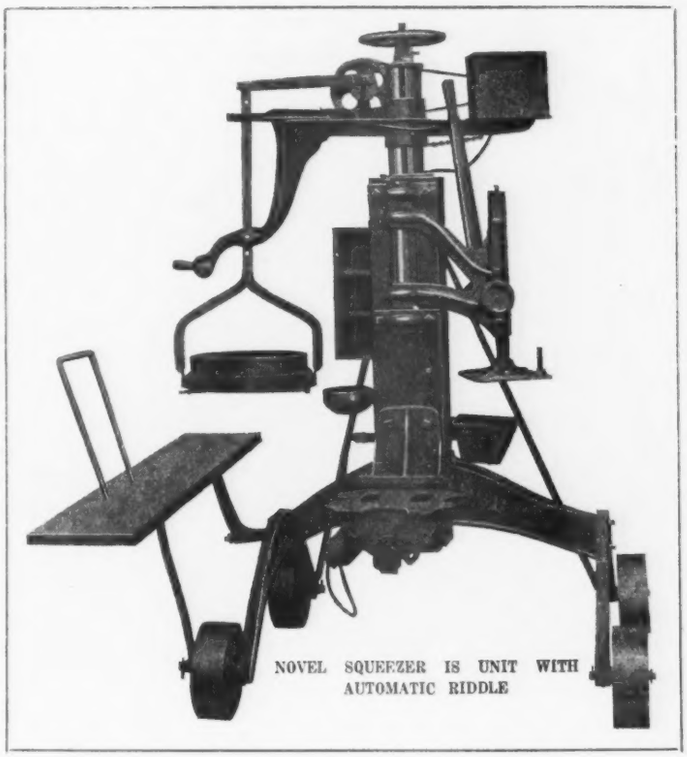
Safety provision has been made so that the air ports prevent the motor from running at excessive speed which might cause the grinding wheel to fracture. Direction of rotation is such that sparks and chips are thrown away from the operator while the load of grinding is toward him. The machine weighs 14 pounds and will accommodate an 8-inch wheel. As the illustration shows, the wheel is protected with an adequate guard.

Design Squeezer With Riddle Attachment

Exhibited for the first time at the Columbus convention, the Chicago Molding Machine Co., Chicago, has introduced a novel combination to a rather unusual squeezer. This machine, which is shown in the accompanying illustration, is designed for snap flask work, and is said to be particularly adapted to deep patterns such as pulleys and jobbing castings of a similar nature on plates, matches of gated work or loose patterns. As may be noted, the entire assembly is mounted upon a wheel carriage which may be moved along beside or directly over a sand heap.

The carriage frame supports a central column upon which a cross frame is mounted. As shown, a light frame holding a common type riddle is pivoted to a drop extension of the main cross frame, and the upper end of the riddle support is connected to a crank driven by a belt from a motor which is housed in the box at the right. The entire supporting frame of the riddle, which is adjustable in height, may be swung around so that the riddle is directly over the table of the machine when it is desired to sift sand into the flask, and may be pushed back out of the way when the successive operations are performed. The motor actuating the riddle is controlled through a push-button switch on the handle shown at the extreme left, by which the frame is swung about. The lower

table of the squeezer is rigid. The upper plate, which is adjustable in height to varying depths of flasks, is swung about a spindle bolted to the side of the main column housing. Pressure is imparted by leverage through the movable arm shown. The movement up and down allows sufficient clearance so that the squeezer plate clears the top of the plate. A set screw adjustment regulates the maximum downward travel of the plate so that too great a pressure may not be exerted. A vibrator is shown attached to the lower table. This may be attached to the flask or pattern plate if desired. Cups supported at the left and right of the main column serve to hold a bag of facing, or swab, while the three boxes at the left may contain other tools required by the molder. The shelf at the left is at a convenient height for the workmen to finish and close the molds if required, while a detachable core frame may be bolted to the supporting frame of the machine at the right.



NOVEL SQUEEZER IS UNIT WITH AUTOMATIC RIDDLE

The entire machine is mounted on a four wheel truck or frame in such a manner that it may be propelled along the floor to follow a long pile of sand, the completed molds being removed and set down close to the machine. Heavy sections are used in the construction of the frame and rigid bracing is provided to furnish additional support.

Data On Patents

The annual report of the commissioner of patents for 1919 contains some interesting figures. During 1919 80,400 applications were received, 34,631 patents granted, 203 patents reissued and 77 patent applications withdrawn. The total number of patents handled was 38,593. Compared with 1916 when 71, 003 applications were handled, and 45,927 patents issued, the figures for 1919 show a decrease of 7329. Among the various states, New York leads the list for 1919 with 5980 patents granted while Illinois and Connecticute are tied with 3899. Among other states where a substantial number of patents were granted are: Pennsylvania, 3111; Ohio, 2505; Massachusetts, 1991; California, 1962, and New Jersey, 1898. In the district of Columbia, 299 patents were granted, 12 in Alaska, 34 in Hawaii, eight in the Philippine islands, seven in Porto Rico, six in the Canal Zone and one in the Isle of Pines. Patents to the number of 49 were granted to officers and enlisted men in the United States army, 14 in the navy and two in the marines.

Patents issued to citizens of foreign countries in 1919 totaled 3687. England heads the list with 1245. Among other countries are: Canada, 819, Sweden, 155; Switzerland, 139, and Germany 131.

In order to increase capacity the Lavelle Foundry Co., Indianapolis, will start work soon on the construction of a new building. The new 1-story structure, together with the equipment will be $50,000.

What the Foundries Are Doing

Activities of the Iron Steel and Brass Shops

The plant of the Lundblad Foundry Co., South Haven, Mich., recently was damaged by fire.

The plant of the Logan Iron Works, Logan, Okla., recently was damaged by fire.

The Illinois Malleable Iron Co., Chicago, plans a boiler and power house, 60 x 89 x 100 feet.

The Superior Castings Co., Dayton, O., plans the erection of a foundry, 30 x 110 feet.

The plant of the Belleville Stove Works, Belleville, Ill., recently was damaged by fire.

Fire recently damaged the plant of the Bass Foundry & Machine Co., Ft. Wayne, Ind.

The plant of the Modern Steel Casting Co., Milwaukee, recently was damaged by fire.

P. L. W. Dupre, 20 St. James street, Montreal, Que., is planning a brass foundry for G. Dupont.

The Lima Foundry & Machine Co., Lima, O., is contemplating the erection of a foundry.

The Chatham Die Casting Co., New York, recently increased its capital stock from $75,000 to $200,000.

The plant of the Galesburg Malleable Casting Co., Galesburg, Ill., recently was damaged by fire.

The iron foundry of H. A. May & Co., Sixty-first street and Eastwick avenue, Philadelphia, recently was damaged by fire.

Work has been started on the erection of a foundry building for the Acme Works, Inc., Indianapolis.

The Chippewa Foundry & Machine Co., Chippewa Falls, Wis., recently changed its name to the Chippewa Pump Co.

Plans are being drawn for the erection of an addition to the foundry of the Engman Mathews Range Co., Gosebn, Ind.

The plant of the United American Iron & Steel Co., South Troy, N. Y., recently was damaged by fire.

Authorization to increase its capital stock from $200,000 to $400,000, has been granted the Manufacturers' Foundry Co., Waterbury, Conn.

Erection of an addition to its foundry, 60 x 110 feet, is being planned by the Berlin Foundry & Machine Co., Berlin, N. H.

The O. K. Stove & Range Co., Louisville, Ky., contemplates the erection of a plant building to be 60 x 200 feet.

The Lycoming Foundry & Machine Co., Williamsport, Pa., plans the erection of a boiler house, 1 story, 50 x 100 feet.

The Oliver Chilled Plow Co., South Bend, Ind., is erecting an addition to its foundry and cleaning building.

An increase in capital stock, from $25,000 to $50,000, will be made by the Newman Foundry Co., Kendallville, Ind.

The Washington Mold, Machinery & Foundry Co., Washington, Pa., recently increased its capital stock from $25,000 to $100,000.

Capitalized at $65,000 the Howell Foundry Co., Detroit, recently was incorporated by Charles A.

Kanter, F. T. Schreiner Jr., and Claude E. Stove.

A. C. Stringer, Chicago, plumbing supplies, is reported planning the establishment of a foundry at Gadsden, Ala.

The capital stock of the Pennsylvania Piston Ring Co., New York, recently was increased from $200,000 to $300,000.

The Jackson Stove & Stamping Co., Jackson, Mich., recently increased its capital stock from $200,000 to $1,500,000.

The capital stock of the Independent Stove Co., Detroit, has been increased from $350,000 to $600,000.

The E. A. Baumbach Mfg. Co., 810 West Lake street, Chicago, plans the erection of a foundry, 50 x 150 feet.

The C. & G. Cooper Co., Mt. Vernon, O., has indefinitely postponed plans for the erection of a foundry and machine shop.

Ground has been broken for the erection of the first of a series of buildings including a foundry, for the Moloch Co., Kaukauna, Wis.

The capital stock of the Automotive Foundry Corp., La Crosse, Wis., recently was increased from $100,000 to $200,000.

The foundry at the plant of the Northwestern Steel & Iron Works, Eau Claire, Wis., recently was damaged by fire.

An increase from $500,000 to $1,000,000, in the capital stock of the A. J. Lindemann & Hoverson Co., Milwaukee, recently was authorized.

The Wilson Foundry & Machine Co., Pontiac, Mich., has increased its capital stock from $5,000,000 to $6,300,000.

The Reading Pattern Works, 551 Cedar avenue, Reading, Pa., plans the erection of a 1-story plant building, 60 x 100 feet.

Woodruff & Edwards, 109 North State street, Elgin, Ill., has plans for the erection of an addition to its foundry.

Arnold G. Glass, Birmingham, Ala., is reported planning the erection of a plant to be devoted to the manufacture of gas ranges.

The Mountain City Foundry & Machine Works, Greenville, S. C., contemplates the erection of an addition to its foundry, 30 x 50 feet.

The Automotive Foundry Co., LaCrosse, Wis., recently increased its capital stock from $100,000 to $200,000.

The Charles H. Milles Foundry Co., 2433 West Twenty-first street, Chicago, has awarded contracts for the erection of a gray iron foundry and office building, to be 100 x 200 feet.

The Jefferson Brass Foundry & Mfg. Co., Philadelphia, recently was incorporated with a capital stock of $10,000, by Abraham Savin, Samuel Siegel and Morris Siegel.

The Strickland Foundry & Machine Works, New York, recently was incorporated with a capital stock of $50,000, by A. H. Strickland, I. Perlam, 8 Bridge street, and others.

The Fridel Foundry Co., Cleveland, recently was incorporated with a capital stock of $25,000, by Vincent Fridel, J. Zrnel, W. L. Klotzbach, A. Streempl and A. C. Lorman.

The Vulcan Foundry Co., Philadelphia, recently was incorporated with a capital stock of $50,000, by G. U. Favorite, F. A. Cabeen Jr. and Wray C. Arnold.

The Monarch Foundry Co., Lima, O., recently was incorporated with a capital stock of $5000, by F. C. Dempster, F. A. Smith, J. H. Davison and D. Dawson.

Capitalized at $500,000, the Geneva Foundry Corp., DeWitt, N. Y., recently was organized by C. H. King, J. P. Rogers and G. A. Lancaster, Syracuse, N. Y.

Bids were closed recently by Clark & Dudhick, architects, Philadelphia, on a factory and foundry building, 50 x 98 feet and 50 x 80 feet, for the Morris Truck & Wheel Co., Philadelphia.

The Pittsburgh Malleable Iron Co., Thirty-first and Smaliman streets, Pittsburgh, plans the erection of a foundry building, 200 x 320 feet. Frank D. Chase, Inc., Chicago, is architect.

The Dressel Mfg. Corp., New York, recently was incorporated to operate a machine shop and foundry, with a capital stock of $800,000, by Joseph H. Strange, South Orange, N. J., and others.

T. W. Ellis, John H. Mitchell and R. W. Ellis were named as the incorporators of the Valley Bronze Co., which was recently organized at West Springfield, Mass.

The Alma Foundry & Mfg. Co., Alma, Mich., recently was organized with a capital stock of $50,000, by E. M. Templin, John Schwartz and H. J. Paulus. The company has obtained a plant which is being remodeled.

The Valley Iron Works, Appleton, Wis., has completed the erection of several additions to its plant, consisting of a gray iron foundry extension and an erecting room, 40 x 135 feet, equipped with an 8-ton crane.

The Fordlette Engine Co., Huntington, W. Va., has been organized with a capital stock of $100,000, by E. G. Livesay, president, A. J. Groves, vice president, and H. L. Grimm, secretary-treasurer. The company plans to erect a building, 50 x 150 feet, and install machine shop and pattern equipment.

The Harley Co., Springfield, Mass., brass founder and drop forger, at its annual meeting held recently, elected the following officers: President, Henry H. Skinner; vice president, Edwin Krause, and treasurer, John D. Stephens. The following were added to the board of directors: Charles E. Childs and William F. Bartholomew.

Under the name of the Peterson Tool & Die Works, 142 Clifton place, Brooklyn, N. Y., Henry Soss, president, C. J. Soss, secretary-treasurer, and Oscar Peterson, general manager, will manufacture stamping and forming dies, die casting dies, etc. It will also do machine and experimental work of all kinds and designing. The company is capitalized at $15,000, and has a completely equipped plant.

The Colonial Foundry Co., Louisville, O., has increased its capital stock from $50,000 to $235,000. The increase has been taken up by present stockholders, according to C. A. Jackson, secretary and treasurer of the company. A 60 x 165-foot addition factory unit is under construction. A 10-ton traveling crane and a 72-inch cupola will be part of the new equipment. With these additions the company expects to increase its output 150 per cent.

Stevens Point, Wis., has been selected as the site of the proposed plant and headquarters of the Farmers' Tractor Corp., a new concern, organized in Wisconsin with a capital stock of $500,000. It will manufacture gas and kerosene tractors for agricultural tillage. Work will be started in the spring on the erection of a machine shop and assembling floor, and later on a foundry will be erected. A. J. Patch, Charles City, Iowa, is chief engineer and William Mainland and James Mainland are associated with him.

Of brick construction with steel trusses and a monitor roof over the fires, the proposed foundry of the Jefferson Brass Foundry, 209-11 King street, Brooklyn, N. Y., will be 40 x 96½ feet, inside dimensions. It will be erected on a plat of land, 100 x 1000 feet and will be equipped with 12 furnaces comprising two each, Nos. 200, 100, 80, 60, 50, and 35. Provisions are to be made for additional furnaces to be installed as needed. A crane will travel the entire length of the building for pouring of metal and for transferring of heavy pieces of floor molding.

The Doud-MacFarlane Machinery Co., 1501-03-05 Dock street, Tacoma, Wash., manufacturer of marine hardware, has advised it plans to erect the first unit of its proposed new plant, which will be a foundry building, 80 x 80 feet. It will be equipped with melting furnaces for brass and iron with electric annealing furnaces for malleable products. The company, which manufactures ship chandlery in iron, steel and brass, will use this foundry for making light castings. R. C. Doud is secretary-treasurer of the company. It is understood the company is not in the market at this time for any new equipment.

New Trade Publications

GENERATORS.—The General Electric Co., Schenectady, N. Y., has publishd a 4-page folder in which small direct-current generators and exciters are described and illustrated.

CRANES—A self-propelled road crane is described and illustrated in a folder being circulated by The Locomotive Crane Co. of America, Champaign, Ill. Specifications and other data are given.

LATHE and PLANER TOOL.—The R. G. Smith Tool & Mfg. Co., Newark, N. J., has published a small illustrated booklet in which a standard radius lathe and planer tool is described and illustrated.

FOUNDRY FLASKS.—The American Foundry Equipment Co., New York, is circulating a 20-page illustrated booklet in which various types of foundry flasks which it manufactures are described and illustrated.

FOUNDRY EQUIPMENT.—The American Foundry Equipment Co., New York, is circulating a 42-page booklet which contains reproductions of letters received by the company endorsing the use of the sand-cutting machine which it manufactures.

GRAPHIC INSTRUMENTS—Recording and measuring apparatus for measuring power, recording equipment performance, testing finished products, etc., is described and illustrated in a 4-page illustrated circular recently issued by the Esterline Co., Indianapolis.

INDUSTRIAL RELATIONS—The Westinghouse Air Brake Co., Wilmerding, Pa., has published a 62-page illustrated booklet, describing the various agencies that it has established to promote the general welfare of its employes and foster harmonious industrial relations. The booklet shows what the company has done in the matter of housing, providing recreation and looking after the general welfare of its employes.

POWER PLANTS.—Dwight P. Robinson & Co., Inc., New York, has published a large folder containing a number of illustrations of power plants, which have been erected by the company. The plants shown include the Cheswick Power Co., Cheswick, Pa.; power plant of the American Brass Co., Torrington, Conn.; plant of the Worcester Electric Light Co., Worcester, Mass.; and the power plants of the Chicago, Burlington & Quincy and the Chicago & Northwestern railroads.

SAND BLAST EQUIPMENT—The Pangborn Corp., Hagerstown, Md., is circulating a 4-page illustrated folder in which sand blasting equipment is described and illustrated. According to the folder, purchases of sand blast equipment in 1920 were comparatively 800 per cent greater than in 1914, based on the sales of the Pangborn Corp. The folder states that the varied use of this equipment ranges from tipping steel pen points to cleaning the largest steel castings.

HEATING SYSTEM.—A 4-page illustrated folder is being circulated by Skinner Bros. Mfg. Co., St. Louis, in which heating systems for plants of all kinds are described and illustrated. One system, a steam coil type, consists of a series of pipe coils compactly mounted above a powerful fan-wheel, all enclosed in a single sheet-steel casing. Coils are heated by either exhaust or live steam, and the fan is operated by any power available. Another type described is the direct-fired type. This consists of a heavy cast-iron combustion chamber, firing port and ash chamber, mounted in a single sheet-steel casing, in conjunction with a powerful fan-wheel. It burns coal, coke or wood.